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4888½ United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and Minerals Separation North American, Appellees.

Substituted Pursuant to Order Filed March 19, 1918, for Incorrect Copy Filed November 10, 1917.

TRANSCRIPT OF RECORD.

Volume 9.

EXHIBITS.

(Pages 4889 to 5565, inclusive.)

Upon Appeal from the United States District Court for the District of Montana.

Filed Mar. 19, 1918. F. D. Monckton, Clerk.

4889 Plaintiff's Exhibit 1.

This Agreement, made and entered into this 22nd day of July, 1911, by and between the Butte & Superior Copper Company, Limited, a corporation created and operating under and by virtue of the laws of Arizona, and doing business in Montana, party of the first part, and J. M. Hyde, party of the second part;

Witnesseth: Whereas, James M. Hyde claims that he has knowledge of a method of treating certain ores of the character of the ore produced in the Black Rock Mine, the property of the Butte & Superior Copper Company, Limited, by means of a process known as "The Gas Bubble Flotation Process," and whereas the said Hyde represents that in his best judgment an increased saving in the milling of said ores being treated by the Butte & Superior Copper Company, Limited, at the mill operated by the said Butte and Superior Copper Company, Limited, at Basin, may be made by the use of said process, and, Whereas, The Butte and Superior Copper Company, Limited, is desirous of testing the efficiency of the said process

with a view of ascertaining whether or not the use of the said process will increase the saving of values at its said mill;

Now Therefore, for and in consideration of the mutual promises and agreements of the parties hereto and the covenants, and agreements hereinafter contained, the parties hereto do hereby agree as follows, to-wit:

4890 The said Company agrees that it will furnish a sum not to exceed Twenty-Five Hundred ($2500.00) Dollars to be used by the said Hyde in the equipment and installation of a fifty (50) ton experimental plant for the use of the said flotation process at Basin, Montana, the said plant to be erected under the supervision of the said Hyde, he to have full charge of the erection of said experimental plant provided, however, that in the construction and operation of the said experimental plant the running of the mill now operated by the Butte and Superior Copper Company, Limited, shall in nowise be interfered with.

The said Company further agrees that the said Hyde may engage his own assistants for the operation of the said experimental plant provided that the payroll of the men employed by the said Hyde in the operation of the said experimental plant shall not exceed Forty ($40.00) Dollars per day, and the said Company agrees that it will pay the said payroll provided the sum does not exceed Forty ($40.00) Dollars per day. It is expressly agreed and understood that the said Hyde shall receive no sum whatsoever as compensation either for the construction or operation of the said experimental plant save and except his personal expenses while engaged in mill work in the said Company's behalf, said sum not to exceed Five ($5.00) Dollars per day.

4891 It is further agreed and understood by the said Hyde that said experimental plant shall be operated for a period of thirty (30) days after its completion, the said process above referred to to be used exclusively in the operation of said experimental plant and that if in the judgment of the General Manager or Superintendent of the Butte and Superior Copper Company, Limited, the plant has not shown that the process used can increase the profits of said Company by at least twenty-five — (25c.) per ton on each ton of ore treated, the Company may at its option declare this agreement null and void and of no force or effect and neither party hereto shall have any further right or claim under this agreement.

It is further agreed that if in the judgment of said Hyde at the expiration of said thirty (30) days' test work in the experimental plant, it does not appear that the process can be used by the Company to enough profit to insure him a sufficient compensation to warrant him in giving further time to the business, he may declare this agreement null and void and of no effect after he has instructed an agent of the Company thoroughly in the details of the process and has released the Company from all further financial obligation to him other than the payment of his expense account as herein provided.

It is further agreed and understood that if the treatment of ore in

the said experimental plant has not indicated that the process can be operated to the financial benefit of the said Company the said Company shall so declare to the said Hyde and this agreement shall be null and void and neither party hereto will have any right or claim hereunder.

4892 It is further agreed, however, that if in the judgment of the General Manager or Superintendent of the said Company, the said process is adaptable to the profitable treatment of the ore mined at the Butte and Superior Copper Company, Limited, mines at Butte, Montana, and that by use thereof a sufficient financial saving can be made by the said Company to justify the adoption of the use of the said process, the Company will immediately furnish funds for the purpose of installing a plant sufficient in size to treat all of the ore not recovered as jig concentrates in the present plant operated by the said Company at Basin, Montana, when the mill is treating 400 dry tons per day, provided, however, that the total cost of said last mentioned plant shall not exceed ten thousand ($10,000.-00) Dollars.

The said Hyde agrees to furnish plans for the erection and construction of said last mentioned plant and further agrees to personally supervise the erection and construction of the said plant, and the said Hyde further agrees that he will make no charge whatsoever for his services in this connection save and except as hereinafter provided for and the said Hyde further agrees that after the completion of said last mentioned plant, he will supervise its operation in the use of the "Gas Bubble Flotation" process for a period of at least ninety (90) days and that during said period he will fully instruct an agent of the said Company in the operation of the said plant so thoroughly that the said agent of the said Company will be able to operate the said plant without the assistance of the said

4893 Hyde, provided, however, that the said Hyde shall not be obliged to devote more of his time to the personal supervision of the plant than in the judgment of the General Manager or Superintendent of the said Company is necessary to its successful operation or for the complete instruction of the said Company's agent. It is agreed and understood that during the erection of the last mentioned plant and during the operation of same the employees of the said Company may have full and complete access thereto, but that during the erection and the operation of the experimental plant the said Hyde shall have the right to exclude any and all persons from the building in which the said experimental plant is being constructed or operated.

It is agreed and understood that the said Hyde shall receive as full remuneration and compensation for all services rendered (excepting personal expense account as herein provided) a sum equal to one and two-thirds of every dollar of increased profit which shall accrue to the said Company through the operation of the said larger plant during any continuous period of thirty days which the said Hyde may select within the first ninety days that the said plant is operating after its final completion and during which the grade of ore

treated has not averaged over twenty-one (21%) per cent. zinc nor less than eighteen and one-half (18½%) per cent. zinc and the tonnage treated has been at least twelve thousand (12,000) dry tons during said period of thirty (30) days, it being understood
4894 and agreed that the said Hyde shall receive no further remuneration or compensation from the said Company save and except the said compensation to be paid said Hyde on the increased profits which have accrued to the Company during the said period of thirty (30) days so selected by the said Hyde.

It is especially agreed and understood that the basis of the increased profits of the said Company in the operation of the said entire plant, upon which increased compensation of the said Hyde shall be based, shall be determined by comparing the profits of the operation of the entire completed plant, including the said flotation plant, with the operation of the said concentrating plant, in the following manner, to-wit:

1. The net smelter returns for the product made during the thirty days so selected by the said Hyde during which time his compensation shall be estimated, shall be calculated on the basis of $5.20 per hundred weight, as the market price of spelter, f. o. b. cars St. Louis, Mo.

2. The milling cost of the concentrating plant as operated before the installation of the flotation equipment shall be assumed to be one dollar and fifty-one ($1.51) cents per dry ton of ore treated.

3. The recovery of the concentrator plant as operated before the installation of the flotation equipment shall be assumed to be seventy (70%) per cent. with the proportion and grades of concentrates, as follows, to-wit:

82% of zinc recovered as concentrate containing 50.8% zinc, no penalty.

4895 5% of zinc recovered as concentrate containing 50.4% zinc, 50 cent screen penalty only.

13% of zinc recovered as concentrate containing 45.0% zinc, 50 cent screen penalty only.

4. In arriving at what shall constitute a dry ton of ore it is agreed that 2.6% of the railway weight shall be deducted from the ore treated during the said thirty days' period.

5. From the sum of the calculated net smelter returns of the concentrating plant after the flotation process has been installed shall be subtracted the total cost of milling all ores in the Basin plant including the flotation plant, the result thereof being a sum herein designated as "Total Results."

6. From the calculated net smelter returns on the same amount and equal grade of ore as treated during the said 30 days on the basis of a seventy per cent. recovery with values as stated in paragraph No. 3, shall be subtracted the total calculated cost of milling in the concentrating plant at Basin, exclusive of the flotation plant installed by the said Hyde, at the rate of $1.51 per ton of dry ore treated, the result thereof being a sum herein designated as "Present Results."

7. The said Hyde shall receive as full compensation for his services hereunder a sum equal to one and two-thirds of the amount represented by subtracting the sum herein referred to as "Present Results" from the sum herein referred to as "Total Results," that is to say, if the sum represented as "Total Results" should be $100.00 and the sum represented as "Present Results" should be
4896 $60.00, the said Hyde shall receive as his full compensation one and two thirds times $40.00, equal in amount — Sixty-six and two-thirds ($66 2/3) Dollars.

It is especially agreed and understood by and between the parties hereto that in no event shall the said Hyde receive as compensation for his services a sum in excess of $30,000.00.

It is especially agreed and understood that the said Company will at the expiration of any thirty continuous days' run of said mill and flotation plant during the said ninety days after the completion of the said flotation plant pay to the said Hyde as partial payment not to exceed fifty (50%) per cent. of the amount calculated by the Superintendent of the Butte and Superior Copper Company, Limited, to be due him on the increased earnings, if any, during the said thirty day period.

It is further agreed and understood that the remainder of the sum, if any, due to the said Hyde as compensation under this contract, shall be paid by the Butte and Superior Copper Company, Limited, upon receipt by the said Company of smelter returns on ores treated during the period, upon which the compensation of the said Hyde, if any, is based.

It is further agreed and understood that in all calculations provided for in this contract and in calculating the amount due said Hyde hereunder, all sums received or to be received by the Butte and Superior Copper Company, Limited, from the sale of lead concentrate shall be eliminated.

4897 In Witness Whereof, the parties hereto have hereunto set their names and seals this day and year first above written.

BUTTE AND SUPERIOR COPPER COMPANY, LIMITED,
By A. B. WOLVIN, *Pres't.*
JAMES M. HYDE.

(Endorsed:) Agreement between Butte & Superior Copper Co., Limited, and J. M. Hyde. Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit 2.

Whereas, James M. Hyde has undertaken certain work in connection with the milling operations of the Butte and Superior Copper Company, Limited; and,

Whereas, under the terms of a contract now existing sums of money to be paid the said Hyde are not yet due; and,

Whereas, the said Hyde is desirous of obtaining at this time, and in the near future, certain payments of money;

4898 Now therefore, the said contract existing is now modified with respect to the time of payment of moneys in the following manner, to-wit:

The said Butte and Superior Copper Company, Limited, has this day paid to the said Hyde the sum of $5,000.00 to apply upon any future payments that might be found to be due, and does agree to pay the said Hyde $5,000.00 on the 1st day of January, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of $5,000.00 for the month of December, 1911.

The said Butte and Superior Copper Company, Limited, agrees to pay the said Hyde $5,000.00 on the 1st day of March, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of $5,000.00 for the month of February, 1912.

It being the intent of this agreement, that if the flotation plant installed by the said Hyde at Basin, Montana, should cause an increase in the months of December and February to the extent of $5,000.00 for each month, the said Company will make the payments aforesaid to the said Hyde; the total payments, however, including the $5,000.00 paid this day, shall not exceed $15,000.00 until such time as the new concentrator of the Butte and Superior Copper Company, Limited, is in operation at Butte, Montana, when a

4899 thirty day run of the selection of the said Hyde may be made in the same manner and within the same time as provided in the original contract between the said Hyde and the said Company, and the Company shall thereafter pay the said Hyde the sum in excess of $15,000.00 if any, found to be due him, not to exceed, however, the additional sum of $15,000.00. If no sum in excess of $15,000.00 is found to be due the said Hyde under the terms of said contract, then the said Hyde shall be considered to have been fully paid and compensated under the terms of said contract.

It is understood and agreed between the parties hereto that the terms of said contract with reference to the amount to be expended in the construction of the larger plant referred to in the contract heretofore existing between the parties hereto shall be considered by both parties to have been fully satisfied without additional expenditure on behalf of the Butte and Superior Copper Company, Limited, at the Basin Concentrator.

The right is reserved to the said Hyde to select any thirty consecutive days' run of the Basin Concentrator during the continued operation thereof by the said Company as the basis upon which his compensation shall be fixed under the said contract, and to demand that settlement be made thereon in accordance with the original contract between the parties hereto crediting, however, all sums theretofore paid him by the said Company as payments upon the amount found to be due him.

4900 In Witness Whereof, the parties hereto have hereunto set their hands and seals this 26 day of October, 1911.

JAMES M. HYDE.
BUTTE AND SUPERIOR COPPER COMPANY, LIMITED,
By A. B. WOLVIN, *Pres't.*

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit 3.

September 21st, 1911.

J. M. Hyde, Esq., Basin, Montana.

DEAR SIR: With reference to the contract which J. Bruce Kremer drew up last June in accordance with terms which were agreeable to yourself and myself and which I submitted to the directors of the Butte & Superior Copper Company, Limited, for approval:

I received on July 6th, from A. B. Wolvin, president of the company, a telegram instructing me to proceed with you in accordance with the contract.

You installed and operated an experimental plant and convinced me of the economic value of your process as applied to Butte & Superior ore, and I have recommended to the directors that the larger plant referred to in the body of the contract be installed at
4901 Basin, at once, but with certain modifications, which seemed under the circumstances governing conditions at Basin to be advisable. I shall not enumerate the conditions in this letter, as they are well known to both of us, but the literal carrying out of the agreements made in the contract with the above mentioned modifications will not be fair to you, and I wish to present to you the following proposition:

You will remain in Basin until the construction of your larger plant is completed and operating, and until the man appointed by Mr. Collins to do the work shall have become thoroughly conversant with the handling of the larger unit. As long as you remain in Basin you are to receive the same amount of money to cover living expenses as was provided in the contract.

After you and I have mutually agreed that the larger plant is operating as successfully as can be expected, you will be at liberty to depart. I have in mind as the date of your departure some time between the 10th and 20th of October, but it may be sooner.

After you leave Basin, you are to continue your investigations concerning the best plans to follow in the erection of the gas bubble flotation unit, which is to be part of the new zinc mill which we are to build at Butte and advise me from time to time of your wishes in the matter, so that the plant may be built to suit you, as far as is consistent with the approximate expenditure of $10,000.00 for apparatus and construction expenses. The building proper is not included in this limit of expense.

4902 During your absence from Basin or Butte, I shall keep you fully posted on the progress and details of the construction of the new mill, so that you can arrange to be in Butte to supervise the completion of your part of the plant and to start its operation. As soon as the plant in the new mill is running smoothly, we shall consider your 90 day test, as provided in the contract, as on.

In consideration of the extended period you will be obliged to devote to our business, you shall have the right to demand an initial payment, under the terms of the contract, of up to $7,500.00 before the end of this calendar year. Or if you desire to remain in Basin for 90 days after your larger unit is running, and accept the results thereof as final, this is to be your privilege, and final settlement will be made under the terms of the contract.

In case of any accident to yourself during your proposed absence from Butte & Superior, which might prevent your return, the Company will consider the terms of the contract binding and pay to you or to anyone you may legally designate such sums as may be due you under the terms of this contract.

If you desire to accept the proposition, as outlined herein, please notify me to that effect and I will forward the proposal to Duluth for confirmation.

Yours very truly,

M. W. ATWATER.

M. W. A./G.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4903 Plaintiff's Exhibit 4.

1041 Shattick Ave., Berkeley, Cal.,

April 24, 1913.

J. L. Bruce, Esq., Butte, Mont.

DEAR SIR: I did not have an opportunity to see you and discuss the company's agreements with me before leaving Butte. As the original agreement does not fit conditions as they have been changed since it was entered into, it will be necessary for me to take the matter up anew with your officers. Mr. MacKelvie has suggested that we get together and dispose of the matter when he is in the west, and I am making arrangements to meet him when he is in Butte early in May.

I enclose herewith my expense account for the recent trip to Butte. The company agreed to pay my actual expenses when my time was given to the suit or to the milling operations. You will see by reference to your accounts that this has been regularly done in the past.

Hoping that all is going as well as can be desired at the mill I remain

Respectfully yours,

JAMES M. HYDE.

J. L. B.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4904 Plaintiff's Exhibit 5.

Butte and Superior Copper Company, Limited.

25 Broad Street,

New York, July 2, 1913.

J. L. Bruce, Manager, Butte & Superior Copper Co., Ltd., O'Rourke Estate Building, Butte, Montana.

DEAR SIR: Under date of June 14th I wrote you in reference to your getting up some data in connection with the Hyde process to use as a basis of settlement with him as provided for in his contract with the company for the installation of the Hyde flotation process.

Mr. Bocking took this matter up in his letter of June 27th. Mr. Bocking forwarded me several statements showing the comparative value of the mill zinc flotation concentrates, also statement showing comparative milling costs.

The direct charges against the flotation department for the month of May he gives as $1.1881. In report form 19B, giving the distribution of cost of mill operation for repairs and maintenance, I find that the total cost against the flotation department is .873865c., so there is a discrepancy there of approximately 31c. per ton.

4905 Mr. Babbitt and myself have had a talk with Mr. Hyde this morning and we feel that the settlement of balance due on Mr. Hyde's contract should be based on report of the operating officials. The maximum amount to be paid to Mr. Hyde under any circumstances is $30,000, and of this amount he has already received $10,300.

In taking this matter up with Mr. Jackling some weeks ago, he stated that he was at a loss to suggest a method of determining what is due Hyde, if, in fact, anything is due him.

I have had in my mind the outcome of the suit of the Minerals Separation Company against Hyde, but the contract with Hyde was entered into with practically full knowledge of this pending litigation, and later the company made an agreement with Hyde to defend this suit for him and at that time did not ask for any modification of the then existing contract. I have not the contract before me but it is my understanding that Hyde had the right to take the results of any 30-day period within three months after the construction work had been completed, and it is Hyde's claim that this construction period was not ended until April of this year and that on the results for the month of May he is entitled to $19,700 as the balance due him.

There is no possible way with the data before us that we can answer any of the contentions that Hyde makes, particularly

4906 in being denied the privilege by the former management of making suggestions in regard to the operation or application of his process.

In Mr. Jackling's absence and in view of the fact that Hyde has to return west today, I have suggested his taking the matter up with you and Mr. Kremer in Butte, and as a result of your conference with him you can recommend to Mr. Jackling and myself the proper basis on which to deal with the settlement of this matter. Mr. Kremer must, of course, be very familiar with the previous arrangements and understanding as to the application of the present contract to the new mill at Butte, although the contract was based on operations of the mill at Basin.

If at all necessary I would be very glad indeed to meet Mr. Hyde in Butte or Salt Lake after Mr. Jackling's return and finally dispose of this matter, but you can familiarize yourself with the contract and if in your discussion with Hyde there are any points you feel should be passed on by Mr. Babbitt from a legal point of view, you might wire me.

Yours very truly,

N. B. MacKELVIE, *President.*

Copy to Mr. D. C. Jackling.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4907 Plaintiff's Exhibit 6.

En route to Washington,

Jan. 5, 1911 (?) 1912.

M. W. Atwater, Butte, Montana.

MY DEAR MAX: Ever since I left you I have been studying over the matters which we discussed yesterday.

Re Rope Drive. It will be very easy for us to determine the exact amount of power necessary to drive a 24″ diam., 3″ high agitator at 300 R. P. M., and at the same time make an important experiment concerning the possibility of increasing the capacity of your Basin flotation plant at almost no cost. As the mixing boxes are 26″ in the the clear they will take this size agitators, and after the test, if it is seen that they are too large for those boxes, they will be available for the new mill.

I consider this test as very important and want to withdraw my final approval of your rope drive, and ask you to hold up the order until this test is made, by one of you with or without me. As I was yesterday informed, for the first time, that the Basin machine cannot handle the tonnage for which it was planned, it seems possible that in the new mill a larger machine than has been anticipated and one that will possibly require more than 2½ H. P. per splindle may be needed.

Will you please have the Iron Works get out a set of pro-
4908 pellers for the side of the machine which is shut down. Make them 24″ diam. 3″ high and have them bored to place on the spindles so that when they are driven as the spindles on that machine

are the strengthening webs will be on the back. Rush them through if you can and have the machine al- ready to run when I arrive if you can possibly do so.

I will have to spend a few days on personal business in Washington and New York but will rush it through and get back to Butte as soon as possible and put in enough time there and at Basin to collect the necessary data and complete the plans for the flotation department of the new mill.

As the directors asked me, after the meeting in your office at which the subsidiary contract was agreed upon, to supervise all of the planning of the flotation department they will naturally hold me responsible as to the success of the same unless my plans are ignored and overridden. I am heartily in favor of a rope drive, but we must be very certain that it will give all of the power necessary to drive the size of machine which we will have to use, and I am not yet convinced that 2½ H. P. per spindle will be enough.

Re Pulp Thickening. All of my experience in drawing thickened pulp from plugs, even under constant pressure, indicates that it is extremely difficult to get a flow of constant volume and thickness by that means. The more I think of the device you have planned for this work the more certain I am that it will be a source of not occasional, but constant trouble to you. There is no more important problem to be met in the new mill than that of giving
4909 the flotation machine a feed of absolutely constant volume and thickness. It is so important as to warrant installing two complete sets of different devices in order to be certain that the best results can and will be achieved. I hope that you will save suitable space for installing two 16″ tanks and their pumps (two units of the device we discussed yesterday) and that you will see the wisdom of having them installed when the mill starts to run, so that there may be no hitch in its work.

My understanding has been that there were to be ample funds available to build the best mill that can be planned. If that is the case it will be very unwise to run any chance of not starting off right, in order to let the mill make money available for further equipment as you suggested yesterday. That policy is an extremely wasteful one at Basin has proven.

I will write a letter to Capt. Wolvin at once making my recommendations with regard to this matter, as we decided yesterday. I believe he will feel that any moderate expense which is necessary to insure the best work is warrantable.

I trust that I shall be back in about two weeks.

With best regards to you all I remain

Sincerely yours,

JAMES M. HYDE.

P. S.—Please have this typed & keep a copy for me.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4910 Plaintiff's Exhibit 7.

Copy

20 B

May 17, 1913.

Mr. D. C. Jackling, Vice-Pres. & General Mgr., Utah Copper Co., Salt Lake City, Utah.

DEAR SIR: I enclose herewith bill for professional services rendered by Sheridan, Wilkinson, Scott and Richmond as referred to me by Mr. Kremer, together with correspondence regarding same. This bill seems very high and Mr. Kremer thinks in view of the fact that such considerable revenue has been derived by them for professional services in connection with the case prior to arguments of the same, that their charges for the argument are unreasonably high and that the same should be $2,000 to $2,350 less than the amount billed.

Will you kindly consider this matter, and in case you are not satisfied with approving the bill, correspond with Messrs. Sheridan and Scott until a satisfactory amount is rendered by them.

Yours very truly,

J. L. B., *Manager.*

J. L. B./F. T.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4911 Plaintiff's Exhibit 8.

20.

B.

Nevada City, Calif.,

July 15, 1913.

Mr. N. B. MacKelvie, 25 Broad Street, New York, New York.

MY DEAR MR. MACKELVIE: The result of our conferences at Butte was that Mr. Bruce and Mr. Kremer came to the conclusion that it would be better if the company's officers and I could agree on a lump sum settlement and not be forced to go into a close analysis of figures and a detailed interpretation of my contract. They were led to this conclusion by the discovery that our conceptions of the way in which the contract should be interpreted were so much at variance, that as they expressed it, we could never settle on that basis without submitting the matter to an unbiased and disinterested third party as a judge or arbitrator.

Of course, such a course as that would lead to delay, expense and controversy, all of which we are all most anxious to avoid.

The admission that a substantial payment should be made seems to be inconsistent with their contention that their interpretation of

the contract is defensible, as by their interpretation of the con-
4912 tract they are able to figure that nothing is due me. The
plea that I should be willing to accept much less than I consider is due me, because the defense of my interests would be costly in time and money is perhaps a forcible argument to one in my circumstances in dealing with a powerful company, but it is not a convincing logical proof that I am not entitled to what was originally held out to me as an inducement to undertake this work, with all of the risks involved in it on the conditions under which I took it up.

As your own attitude has been so fair in this matter and Mr. Bruce and Mr. Kremer are convinced that a substantial payment should be made me, it ought to be possible for us to come to a just and friendly conclusion of the matter. My own desire is that the termination of our work together may be marked by a recognition upon your company's part of the great service I have rendered in solving your difficult ore treatment problems, accompanied with such a cash settlement that I can feel that I have been dealt with in a thoroughly fair and broad-minded spirit.

I wrote to you some time since that I should leave the matter of the interpretation of the contract entirely to your board of directors. I should not be prompted to any further explanation of the case if it were not for the great injustice and professional injury done me by the suggestion that my recommendations have lead to the installation of an unsuccessful plant which caused your company great
losses, and that success was only attained after my plans were
4913 greatly changed by other engineers. I feel that that suggestion was prompted by a lack of knowledge of the facts of the case.

Knowing human nature as I do, I have foreseen that such a contention might possibly be raised, and I have carefully preserved my records, data, and correspondence, and have accumulated a mass of evidence which, I am absolutely confident would, in case of necessity, convince any unbiased umpire, board of arbitration, judge or jury that my plans were never substantially adopted until the month of April 1913, and that instead of my plans having caused the company great losses, the fact is that the refusal to adopt and work in accordance with my plans has cost the company an unnecessary loss of over half a million dollars.

It was not until April 1913, that the ore was ground approximately and continuously to such a degree of fineness that good recovery and a good grade of concentrates could be made simultaneously, and the pulp thickening plant was only then so amplified that it was no longer the practice to throw away a considerable portion of the finest and richest part of the ore untreated.

The tacit refusal of the old management to adopt and use my plans as called for by the contract has caused me great professional and financial damage, has denied me the advantage of a prompt demonstration of the striking value of the process I have perfected and has denied me the use of my money which would have long

since been due and paid, and would have been of great value
4914 to me during the period of financial depression through which we are passing. While these are matters which were not under your individual control, they are acts of your company which you should give due consideration in coming to a fair settlement with me.

In order to take a fair view of this matter, it is essential to understand the conditions under which my relationships with the company were entered into, and the steps through which they have progressed. The misunderstandings which have arisen and the fact that some of those who are to pass upon this matter have no personal knowledge of the history of the transaction warrants a brief statement of the case.

In March or April 1911 I arrived in New York from London with H. C. Hoover. From Chester Beatty, Hoover learned that an examination of the Butte & Superior Mine was to be made by Kuehn to determine if Hayden, Stone & Co., would be warranted in taking up a bond issue on the property. I was introduced to Beatty and it was arranged that I should go along and assist Kuehn in the examination, and that when through with it I should make an independent study of the treatment of the ore at my own expense and report my findings to Hoover, who I was informed, with Beatty, was to have the privilege of participating in the bond issue, and who had agreed to carry me for an interest with them if my work showed that they were warranted in going into the venture.

After completing the regular examination, I commenced
4915 a study of the ore with a test machine I had had the local iron works build for me. I got R. M. Atwater's permission to do so and he was very desirous that I should report my results to him. I refused to do so as I was making the tests at my own expense and had no occasion to report to anyone save Hoover, who I understood had some negotiations on in which he would take care of me.

Nutter, representing Minerals Separation, was present in Butte at this time, negotiating with the company, and shortly afterward went with the president and manager to New York.

Just after his return to New York, I received a request from Kuehn for some report of the results of my tests as they were needed by his principals in determining whether or not to take up the venture. After consulting my associates by wire, I furnished him with a statement that the results were satisfactory and showed that greatly increased profits were possible. I understood from him later that my report was a factor in determining his principals to take up the bond issue.

Shortly after this, I received a request from R. M. Atwater to make a study of their problem and report to them what could be done and how it could be accomplished.

At about this time I was informed by M. W. Atwater that the company had found it absolutely impossible to come to terms with Minerals Separation and that they would like to have me investigate the problem of their ore and tell them what I could do. As he

4916 was very urgent in the matter I cabled Hoover to learn how his proposition was developing, and received word from him that he was out of the venture, and to proceed independently if I saw fit to do so. I refused the meager compensation offered me by your company for a study of the problem, but told Atwater that I would make a sporting proposition out of it and would make a comprehensive study of the problem and report to them, charging them only actual costs for the investigation, on condition that they would make me a proposition after receiving my report, which proposition I would either accept or reject and give no further time to the matter.

Upon receipt of my report they made me the proposition which is embodied in my contract with the company dated July 22, 1911.

The essence of this contract was that I should carry out a test with a fifty-ton machine, receiving merely expenses for doing so, at the conclusion of which test, the company would, if the results obtained had warranted it, build a plant according to my plans and under my direction, which I should personally superintend the running of for ninety days' time, and that I should receive as my compensation one and two-thirds time the increased profits made, over certain assumed previous results, in a thirty day period as a result of the use of the process introduced by me.

As first proposed, ten thousand dollars was suggested as the maxi-
mum fee to be permitted. I informed the company that as
4917 I was taking this as a sporting proposition that limit did not seem fair to me, and they raised it to thirty thousand dollars to induce me to take the matter up.

The 50-ton test machine erected and run under my directions for thirteen consecutive days gave a recovery of 91% and a product averaging 51.4% zinc as shown by assays and actual shipments.

It was decided to build a larger machine, and that part of my plans relating to the machine itself was carried out. This machine gave for the month of November, 1912, by the figures furnished me, 89.9% recovery in the form of a 48.2% product. The lower grade product was due to treating coarse material. My plans referred to in the contract were to cover the subject of pulp collecting and thickening, fine grinding of jig and table tailings, and the flotation treatment of all the ore, not recovered as jig or table concentrates. The company decided that they did not want to introduce the fine grinding and pulp thickening portion of my plans at Basin and a subsidiary contract was entered into postponing a final settlement until the completion of a mill in Butte. It was my understanding with the directors that my judgment and plans were to be followed in the new mill in those matters which were covered by the agreement with regard to the Basin mill.

For the new mill I planned the use of two four spitzkasten ma-
chines with 36′ cells, gear driven, and equipped with both air lifts and special pumps, to be accompanied with the use of the
4918 two three spitzkasten 28″ cell, gear driven machines from the Basin plant. That installation would have had more capacity than the one now installed at Butte, and was practically of the type

to which the Butte equipment was changed in April. The two machines at Basin were abandoned and left there, although they were in first class condition. The gear drives advised by me were abandoned for belt drives, which caused endless trouble and were replaced with gear drives early this spring.

My recommendation was that in addition to other pulp thickening device, there should be installed, as a safety measure, special automatic mechanical filters, which were not adopted, with the result that enormous losses of easily recoverable high grade mineral have taken place, and that the cost of treatment in the flotation department is still higher than it would be if these filters were being used to allow the re-use of the hot, acid, oil bearing water which could easily be recovered from the flotation tailings.

In my original report, in subsequent reports, in a series of brief notes prepared last fall for your engineers, and in tests and microscopic examinations made this spring, I have pointed out the absolute necessity of fine grinding if the best commercial results are to be obtained. Yet it was only in April 1913 that the fineness of crushing necessary to the obtaining of the maximum profits was adopted as a consistent policy.

4919 Reference to my letter to you, of June 6th, 1912, written in response to your request that I should inform you of the outlook at the mill, will show that when the mill was first started I was foretelling the difficulties which have been experienced, and protesting, as I had done during the erection of the plant, against the management's refusal to adopt my recommendations as called for by contract.

For the refreshing of your memory and for the information of others of your directors whom I assume will see this letter, I will here again record the results which have at times followed the partial adoption of my suggestions as to how the plant should be operated. These records are suggestive of what phenomenal results would have been at any time achieved had my recommendations been carried out in full under my own personal supervision.

When I visited Butte in early December, as I returned from attending the taking of testimony in the patent suit, I found that the results which were being obtained in the mill were extremely unsatisfactory because the pulp was not being ground fine enough to treat, the slime thickening devices were inadequate for the tonnage being treated, and the use of chemicals in pulp thickening was done in such a way as to unfit the pulp for subsequent flotation treatment.

I went over all of the factors necessary for success with Frank Janney, Jr., and readjustments of manipulation were adopted and a lesser tonnage treated, giving tailings as follows:

4920 (I have no data at hand as to grade of concentrate, etc.)

Dec. 8, 1912,	Flotation tails	3.5, 3.1, 3.3,	Mill tails	5.1, 5.3, 5.2
Dec. 9, 1912	"	"	2.4, 4.9, 2.6	"	"	3.4, 5.2, 4.3
Dec. 10, 1912	"	"	2.7, 4.3, 5.6,	"	"	3.6, 6.4, 9.1

A study of all the mill feeds and products indicated that a recovery of 80% or better was being obtained, and certain alterations to bring the plant more into accord with my plans were agreed upon. As it would take some time to install these, I went to California.

The next I knew of results, I received word from you that the plant was making a very poor recovery, and went to Butte at once and found the following types of tails being produced:

Jan. 8, 1912,	Flotation tails	5.6,	7.0,	12.2	Mill tails	9.3,	13.2,	12.1
Jan. 19, 1913	"	"	7.8,	7.4,	4.4	"	"	11.6,	12.7,	8.2
Jan. 20, 1913	"	"	6.0,	9.7,	6.0	"	"	11.0,	12.4,	7.8

A study of the operations of January 23, 1913, showed the following facts:

Ore milled 785 tons @ 21.4% zinc.
Mill concentrates 110 tons @ 42.9% zinc.
Flotation concentrates 120 tons @ 46.1, 46.8, 49.4.
Flotation tails 470 tons @ 6.2.
General mill tails 555 tons @ 8.9.
Overflow slimes thrown away untreated: 85 tons @ 23% zinc.

These figures show that as the operations were carried on,
4921 with exactly the same equipment which gave the results shown above for January 8th, 9th and 10th, a large proportion of the zinc was thrown away as overflow slime, and that the material going to the flotation department was too coarse to give either a good recovery or a good grade of concentrate. The principal difficulty was that a larger tonnage was being milled than the mill could treat profitably.

Mr. Frank Janney, Jr., joined me at the mill, and ordered that the tonnage be cut down until the tube mills of the second section, which were standing idle, could be hooked up to handle part of the products of the first section. By correcting the tonnage and other factors, the following results were obtained:

Jan. 29, 1912 Flotation tails 2.8, 3.0, 2.9. Mill tails 5.6, 5.8, 7.3 again indicating such a recovery as obtained when operations were modified at my suggestion in December.

Even better tailings than these were obtained later, but the concentrates still showed that the grinding was not fine enough to free the quartz from the blende sufficiently to give high grade concentrates.

My suggestion that the tailings from the cleaner should be reground, which was made as early as when the mill was being planned, was adopted in April, 1913, since when the concentrates have been of a higher grade.

After I had gone over the many factors involved in the
4922 work and shown Mr. Frank Janney, Sr., what my original plans called for, he did me the justice of telling me that he could see that if I had been given an opportunity to do so, I would have made a great success of the work long since.

I wish at this time to acknowledge my indebtedness to him and Frank Janney, Jr., for the efficient way in which they have adopted

my plans as fast as I have been able to convince them of their practicability and for the assistance which they have rendered in whipping things into good mechanical condition.

It should be perfectly apparent to any fair-minded person that in view of the facts of the case, it would be doing me a great personal and professional injustice to hold me responsible for the poor results which have followed from spurning my plans and going contrary to my repeated counsel and advice.

Even had my plans been followed in full, instead of in part, it would have been necessary to have had all the work of pulp thickening, fine grinding and flotation done under my exclusive supervision, for such a period as ninety days, as the contract plainly called for, in order to give me an opportunity to demonstrate the economies and profits of which the process is capable, and never since the first tests on the fifty ton machine have I been permitted to have charge of all of the parts of the work necessary to insure the best results.

It is now plain to all concerned that your ore is one which is especially difficult to treat successfully, yet I have worked
4923 out a special process for it which gives at once a higher recovery and higher grade product than have ever been made from a similar ore so far as I can learn, and which could not be obtained by any other known process.

Had you dealt with Minerals Separation, I am informed by Capt. Wolvin that they would have demanded a royalty of 25c. per ton for the period covered by the life of their patents. That would have amounted to a royalty of $90,000 per year on a thousand ton mill. Even if that rate had been cut in two, it would have been $45,000 per year on a 1,000-ton basis, for about twelve years' time. They had never used the exact process which I have invented and patented even in Australia where they have done most of their work, and that exact procedure is apparently necessary in order to get such results as I have achieved with your ore.

The fact that a patent suit would result from proceeding to use a flotation process was known to all concerned, and the three attorneys upon the old board of directors should have been able to anticipate what a suit would mean in the way of costs. Our relationships are in no ways modified by the fact that the suit was brought in my name. Its object is to enjoin your company from the use of the process or compel it to pay a royalty, and is brought against me solely for the performance of acts carried out for your company.

Had it been brought in your company's name direct, it would
4924 have cost as much to defend it, and I would have given it as much of my time as I have. I am of course aware that it will be greatly to my advantage to win this suit, and I am glad to express my appreciation of the liberal attitude of your board toward this whole matter of litigation.

I did not enter into this business as an impecunious engineer anxious for an ordinary fee. I had given up a position that would have paid me $10,000 per year in order to work for myself, and I have, during the pendency of this work and suit, refused to consider the managership of one of the largest Australian zinc companies

at a salary of £3,000 per year and perquisites, in part, because it was necessary to devote my time to this case and your work.

I entered into this work as a sporting proposition, taking most unusual risks of all kinds, and considering that I was allying myself with people who were willing that, if I made money for them, I should make money with them.

The solution of the ore treatment problem which I worked out was a large factor in increasing the market value of the stock to such a point that the bondholders could, if they saw fit, make 400% on their money, and will undoubtedly assure them of future opportunity of the same sort. The maximum profit that I could possibly make out of the venture is insignificant in comparison with the contribution to the success of the business which my process has proven to be.

4925 I have told Mr. Kremer that, while I consider that the full maximum fee should come to me, which would entitle me to a further payment of $19,700, I will accept $15,000 to avoid any prolonged discussion and possible controversy. I really hope that your directors' sense of sportsmanship and fair play will make them recognize that that is a concession which should not be demanded, when they understand the case fully. The full amount is scant compensation for the service rendered, to say nothing of the trouble, worry and neglect of other business which have been involved in this suit to gain you the right to operate without paying regular tribute to a fraudulent monopoly.

Mr. Bruce will go ahead with the preparation of figures to submit to me if it becomes necessary to go closely into all details of cost and recovery, and I shall not go into an analysis of figures until I have their recommendations while waiting to hear from you.

At the time the contract was entered into, Mr. Atwater and I figured that the process should yield approximately 90% recovery and a 50% zinc concentrate; that the extra costs of treatment should be 55c. to 65c. per ton, and that, on that basis, I would be entitled to $30,000 in full when but 12,000 tons per month were being treated.

The only figures so far submitted to me show that approximately 90% recovery and 50% product have been achieved. The detailed figures which Wicks showed me for one of the early spring

4926 months showed flotation department costs of about 60c. per ton. (I do not know how the high costs figured for May were derived.) Apparently our early forecast has been practically achieved, and on that basis by the terms of the agreement, I have assumed that the maximum fee should be due me, even if you had treated but 12,000 tons in May instead of 22,000 tons as you did.

If a settlement can be made as Kremer and Bruce suggest, on the merits of the case, it should not be necessary to await the preparation of more figures, and I shall be greatly pleased to be spared the necessity of making another long, expensive and tedious trip to attend to the matter, if it can be attended to promptly by correspondence.

However, if you consider it desirable for me to meet you and

others in Salt Lake or Butte, I am willing to do so, if other plans permit, at such time as you may suggest.

I shall be glad to hear what you wish to propose in the matter.

Realizing that you agree with me in hoping that the whole affair may be disposed of within a short time, I remain

Respectfully yours,

(Signed) JAMES M. HYDE.

My address will be 1041 Shattuck Avenue, Berkeley, California, as before.

4927 Hayden, Stone & Co., 20.
Bankers, B.
New York-Boston.

New York, July 28, 1913.

Mr. J. L. Bruce, Butte, Montana.

DEAR SIR: For your information I am enclosing copy of a letter I received from James M. Hyde, which was written after a conference with you and Mr. Kremer.

Yours very truly,

N. B. MACKELVIE.

N. B. M., S.
Enclosure.
J. L. B.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4928 Plaintiff's Exhibit 9.

Sept. 16, 1913.

Mr. F. G. Janney, Manager of Mills, Utah Copper Co., Salt Lake City, Utah.

DEAR SIR: Complying with your request of Sept. 3rd I have gone over the attached correspondence with Mr. Shimmin, and have endeavored to show in this letter our opinion as to Mr. Hyde's connection with the flotation process.

We have gone back over the early records and correspondence in connection with the subject and, with the exception of three or four free hand pencil sketches cannot find in the files any drawings, blueprints or designs of any description which were gotten up by Mr. Hyde, nor any that bear Mr. Hyde's signature of approval, nor can I find any record of his having submitted any detailed drawings of flotation machines or flotation installations of any kind.

In numerous letters Mr. Hyde refers to the preparation of plans and to the various schemes which he had in mind but there is no record of any finished drawings having been submitted which could have been used in the erection and installation of machines of his design. The sketches, notes, etc., which Hyde did submit to this

company are on file and originals or copies of them can be
4929 forwarded to you should you desire them, but they are for the most part free hand, without dimensions and decidedly incomplete and they bear very slight resemblance to the machines now operating.

It is very evident from the early correspondence in this matter that from the beginning of Mr. Hyde's connection with this company a great amount of difficulty was experienced in obtaining from him any definite design or description of the type of machine which he desired them to install in the first place, and after the original machines were erected and failed to produce the desired results, his suggestions for improvement were decidedly hazy and intangible and consisted principally of criticism of the installation as it existed rather than instructions for improvement.

These conditions existed from the first, but copies of letters written to Mr. Hyde by Mr. Atwater indicate a willingness on the part of the Butte & Superior to follow Hyde's instructions on the first installations, as the flotation problem was entirely new to any connected with the company. The difficulties encountered in obtaining satisfactory results from Hyde's work is shown in the following paragraph quoted from Mr. Atwater's letter to Captain Wolvin under date of Oct. 4th, 1911, a signed copy of which is in our files:

"Hyde has proved to be an excellent theorist, but a very poor practician. His process, I am sure, is all right, but Collins and his men have had to put in into shape to run and Hyde's repeated
4930 mistakes in the design of apparatus and his inattention to minor, though important, details have consumed a good deal of unnecessary time. I have always given him a free hand and made it a point not to interfere in any way with his plans and projects, except as to their magnitude, but recently while discussing the failure to work properly of several features of his old and new plants, he said that he did not consider himself to be a practical man in any respect; so I proposed that he explain his process fully to Collins and leave all further points of construction as well as details of operation to Collins with Hyde acting as an advisor only and not as an administrator as heretofore. Hyde gladly accepted this arrangement. He and Collins got along very well together and I think that henceforth there will be fewer jobs in his department that will have to be done twice or three times before they are correct."

You will note that this letter was written less than three months after the closing of the contract. This shows clearly the difficulties which were experienced in obtaining satisfactory results from the first machine erected, and it was only by repeated alteration and rebuilding that the machine produced any results at all. About three months later, or in February of 1912, Mr. A. H. Rogers made a test of the flotation installation at the Basin plant and in conclusion on Page 23 of Mr. Rogers' report, dated March 5th, 1912, he says:
4931 "The process has shown to be well adapted to the treatment of the Butte & Superior ore, even as carried out in the apparatus installed at Basin. It is believed, however, that there is room for improvement in this apparatus attaining thereby both improved

metallurgical and economic efficiency * * * Experiments to decide the best type of apparatus are strongly recommended before deciding on the design of apparatus to be installed in the new mill. * * * It appears therefore that there will be a very decided advantage in the use of the process in the new mill but no time should be lost in deciding on the form of apparatus to use."

During the early part of 1912 there was considerable correspondence between Mr. Hyde and Mr. Atwater discussing various designs which both had in mind leading up to a cablegram from Hyde who was then in London. This cablegram is dated July 30th, 1912, and reads:

"Am forwarding plans new pumpless machine on one level. Await these before building new machine."

(Signed) HYDE.

The plans referred to were those referred to in his letter from London the following day in which he says:

"I am enclosing herewith a sketch with dimensions for a
4932 new flotation machine for the uncompleted side of the mill. It is along a line discussed between myself and Mr. T. J. Hoover over a year ago * * * Referring to the sketch you will note that the machine consists of a number of agitators and overflow boxes built together into a single continuous tank through which the froth flows in a practically straight line."

The machine referred to in this correspondence was built as shown by Mr. Atwater's letter to Mr. Hyde dated Aug. 27th, 1912, in which he says:

"I also have for acknowledgment your cable of July 30th requesting that we await for plans of new pumpless machine. Your letter describing the new machine and enlosing sketch of same arrived in due time. We have five cells complete according to your drawing and are now putting them into place. The grave doubt that I have in my mind that the machine will work is caused by the small settling area of your spitzkasten."

In this letter Mr. Atwater goes on to explain to Hyde a number of improvements which they had made in the machines then operating and in conclusion says:

"At the Butte Reduction Works the Minerals Separation have built a machine just like the drawings that you sent me excepting that they have a spitzkasten in front of every cell and the propellor in each cell acts as a suction for the feed from the spitzkasten back to the next propeller. I believe this will be an improvement
4933 over yours because it looks to me as though there would be a heavy deposit in each spitzkasten as you have drawn them; but if the machine will work the advantages of doing away with the pumps and more uniform flow through the machine are so obvious that we will try it as soon as we can."

The machine referred to in this correspondence was at that time being built according to Mr. Hyde's sketch as nearly as possible. It consisted of six agitators in one row while the spitzkastens were

inserted between the agitators so as to form one continuous line of boxes. The depth of the spitzkastens was designated as 16 inches below the water line and this machine bears scarcely any resemblance to the one now in use.

On Sept. 11th, 1912, Hyde answered Mr. Atwater's letter of August 27th by submitting two additional sketches showing a machine having the same identical type of spitzkasten but the agitators and spitzkastens were placed in separate lines or rows and connected by means of 6" pipes so that the pulp might flow alternately from an agitator to a spitzkasten and thence to the following agitator. This change in design was produced by Mr. Hyde principally to make it different from the one which the Minerals Separation were building at the Butte Reduction Works but in this letter Hyde did not attempt to explain to Mr. Atwater why any of the difficulties
4934 which Atwater anticipated would not result after the machine had been completed. In fact he offered absolutely no suggestions except one taken from an old report of Froment's in which he suggests a revolving rake in the spitzkasten to prevent the coarse material from settling.

On November 9th, 1912, Mr. Atwater wrote to Hyde who was then in New York on his way home from London. In this letter Atwater says:

"* * * The flotation unit which we built in accordance with the drawings you sent us from London did not work out at all. The pulp would not float through the machine and if it had flowed through the machine the spitzkasten would have been much too small to allow the concentrate to rise as well as in the old machine. I think before you left here we had begun to install 8' spitzkasten in place of the shorter ones and the spitzkasten on the new machine were much smaller than those on the original machine."

He also goes on to say that difficulty was still being experienced with the treatment of slimes and that the Minerals Separation at the Butte Reduction Works were having the same trouble: "to-wit: a very high oil consumption and a very poor recovery whenever the percentage of slimes in the feed becomes great. Green has been running a number of tests on the flotation feed to determine a benefit derived by allowing the pulp to stand for a period of time in
4935 contact with a weak solution of acid before treatment. He finds that whenever he allows the flotation pulp to stand for an hour or more with addition of two pounds of acid per ton of solids that he gets a good tailing and a good concentrate in the laboratory machine, regardless of the percentage of slimes and using from four to six pounds of oil per ton of ore. His tests have been so successful that we are now preparing to handle the mill pulp in this manner."

He then goes on to explain the method of operating the settling tanks which it was expected would give the desired time for acid bath and in conclusion he says:

"I would like very much to have your opinion on the above mentioned points * * * We will get more slimes into the flotation plant from the North side of the mill than we are now getting from the South side and I think that the flotation heads will be much

lower in grade, therefore the outcome of the acid digesting scheme is of material interest."

In reply to this letter Mr. Hyde wrote from the office of Hayden, Stone and Company, New York, under date of Nov. 18th, 1912:

"Your letter of Nov. 9th was received. I am sorry to hear that you still have trouble with the treatment of slimes and think
4936 that the prolonged treatment of weak acid which you suggest is very likely to be helpful. In the final adjustment of the plant, however, one of the most vital matters to be arranged will be to have the crushing so adjusted that an absolute minimum of slimes will be made."

Nothing further in the way of suggestions, advice or criticism is offered in the remainder of this letter and Hyde does not refer in any way to Atwater's statement that the flotation unit, which was built according to Hyde's design, had proven an absolute failure even though he acknowledges receipt of the letter containing this statement. In the latter part of the letter, which consists mainly of a discussion of the possible value of pine tar oil, Mr. Hyde says:

"I will leave here within a few days on my way to California and will stop off at Butte and see if I can be of any further assistance to you."

About that time my own personal knowledge of the matter began and I recollect very clearly that Mr. Atwater discussed the situation with me, outlining the various events indicated by the correspondence quoted from, and it was very evident at that time that Mr. Atwater had practically abandoned the idea of obtaining any satisfactory results from Hyde's design or his advice or his presence at the plant. Neither Hyde nor anyone here at that time could give the reasons for the inefficiency of the flotation plant as it
4937 was considered more or less of a mystery among all concerned, except Shimmin, who told me upon my first visit to Butte in November that he and Peterson "could fix up flotation if the bunch would give them a chance."

The scheme for time treatment of slimes mentioned in Mr. Atwater's letter of Nov. 9th was a plan suggested by Shimmin and he had Green do the first work on this proposition, and submit a report together with a proposed flow sheet which would admit of time treatment of slimes by acid. Shimmin worked with Green on this proposition for some time and it was a modification of this plan which represented the final solution of the problem of successfully treating slime material in the flotation plant.

Shimmin saw the Hyde machine operating, or rather was present during several attempts to make the machine run, and he states that it was absolutely impossible to get a flotation pulp of any consistency to flow through the machine and that the action of the agitators in the agitator cells threw most of the feed out of the machine altogether. You will note that this was Hyde's design of a machine for the uncompleted side of the new mill. The machine which was then operating in the other side of the mill consisted of three spitzkastens on the rougher side and three on the cleaner side. I do not know just what the original installation in the new mill consisted of but

the equipment which was operating in October and November of 1912 had at that time been altered, remodeled and torn
4938 out and rebuilt a number of times since the beginning of operations in June and none of the arrangements which had at this time been devised *and* proven in any way satisfactory. There was nothing in the results being obtained at that time which would indicate any likelihood that a 90% recovery and a 50 % concentrate would ever be obtained by the use of the flotation process in connection with the jigs and tables.

There is nothing in the correspondence or sketches on file to indicate the truth of Mr. Hyde's statement that for the new mill he had planned to use two four-spitzkasten machines with 36″ cells, gear driven, together with two three-spitzkasten 28″ cell gear driven machines from Basin. There are several sketches of double 3-cell machines but the first 4-cell machine shown is the cleaner which was designed in December, 1912.

Regarding the 28″ machines at Basin which Mr. Hyde states were abandoned and left at that place, although they were in first class condition, appear to have been left at Basin by direction of Mr. Hyde as on May 24th, 1912, Hyde wired Mr. Atwater from New York as follows: "Want machine left at Basin if possible without involving any complications by leaving it open to inspection."

In December of 1912 when you were here with Mr. Jackling and Mr. Bradley on the way to Alaska, Hyde was here also and at that time there were two machines designed by Mr. Bradley who put into logical form the recommendations of Mr. Hyde. One of these
4939 machines was the fifty ton test machine which was later partly erected but not finished on account of our work in connection with the big machines having shown that the fifty ton test machine was in no way adaptable to the work it was expected to do. This test machine is in no way similar to the large machines now operating but was considered by Mr. Hyde as the acme of perfection and was built from plans approved by him. The other machine designed at that time was the 4-cell cleaner machine which caused us so much trouble during January and February. This consisted of four agitators and four spitzkastens but the type of spitzkasten was entirely incorrect in that it was too wide along the overflow weir and too short when measured from the agitator side to the weir so that we found it actually produced at times a lower grade of concentrate as a finished product than was produced on the first and second cells of the rougher machine of local design which was then operating in connection with the cleaner. This cleaner machine was built absolutely according to drawings gotten up by Mr. Bradley and with Mr. Hyde's approval and it was operated, if I remember correctly, until we shut down in April to remodel the whole flotation plant.

At the time of Mr. Hyde's visit in December neither the mill nor the flotation plant were doing satisfactory work on account of the fact that we were changing from the old section to the new or remodelled section of the mill. In my report covering the first ten-day period of December I stated.

4940 "Operations were somewhat irregular and results a little erratic due to the starting of Section Two and closing down of Section One on the third and fourth of the month."

In Hyde's letter he enumerates the tailings assays of December 8th, 9th and 10th showing the difference between the flotation tailings and the general mill tailings. These assays were correct so far as the samples were concerned but they did not represent the actual work of the plant as mineral was accumulating in all portions of the mill such as the new elevator pits, new 40' settling tanks and other places so that the flotation plant received a much smaller tonnage of actual mineral during the first few days of operation of Section Two than was represented by the tonnage taken in at the head of the mill. This is shown by the fact that the tailings on the 11th averaged 8.1% and the average for the month of December was 7.1% in addition to which there was an under-run for the month of 676,000 lbs. of zinc which would represent a 1% higher tailing than the assays indicated on account of mineral accumulated in various portions of the mill.

The alterations mentioned in Mr. Hyde's letter which were at that time agreed upon consisted of the installation of the new cleaner machine of his design and the installation of a few additional potform pumps of Hyde's design to take the place of the air lifts or to
4941 assist them in handling the feed. Contrary to Mr. Hyde's statement as to the results obtained during January there was an improvement in recovery during that month as compared with December. During December the mill produced 3,985 dry tons of zinc concentrate averaging 47.8% representing a recovery of 61%. In January the mill produced 5,604 dry tons of zinc concentrate averaging 47.6% zinc which produced a recovery of 68% showing that the net increase in recovery was approximately 7%. The high grade of averaged general tailings in January was caused partly by a larger tonnage being treated but was principally due to the intermittent operation of the flotation plant and also to the retreatment of a large quantity of slimes which had accumulated in the 40' settling tanks during December and the first part of January. You will recollect that at the time of your visit here with Mr. Janney, Jr., in January, after your return from Alaska, we were having trouble with the Garfield tables and among other changes made by Mr. Janney, Jr., at that time he had the riffles changed on these tables, increased the slope of the decks and made other changes which greatly improved their work. This materially improved the work of the entire mill, relieved the flotation plant of considerable mineral and by making a very large recovery of coarse concentrate at the expense of the grade we were able to show an improvement in the estimated recovery of the entire mill. The operation of the tube mills on Section One mentioned in Hyde's letter was not suggested by
4942 him as we had previously taken this matter up with Mr. Janney, Jr. I recall that at that time Mr. Hyde was complaining that the material for flotation treatment was not ground to the correct fineness and that there was also too much slime in the flotation feed and his suggestion to Mr. Janney, Jr., in my presence

was that all feed to the flotation plant be ground through 50 mesh. In the discussion which took place about that time between Green and Hyde and others, it was deemed essential by all concerned that the flotation feed consist of a combination of various sizes of sand together with a limited amount of slime. It was the general impression at that time that neither a slime feed nor an entirely sand feed was desirable but that a mixture of various sizes was required, the theory being that the coarse particles assisted in bringing up the fine particles of mineral and also admitted of more rapid settling of the silicious portion of the pulp. It was for that reason that Hyde stated that he believed the best results might be obtained by grinding through 50 mesh instead of grinding finer on account of finer grinding producing too large a proportion of slime for flotation treatment. This is quite contrary to Hyde's original report in which he states that best results would be obtained by grinding through 150 mesh screen in order to obtain an ultimate recovery of 90%.

All of the improvements made in the flotation plant such as the addition of spitzkastens, rearrangement of flow, etc., made during the first three months of 1913, were made by direction of Mr.
4943 Janney, Jr. These were improvements suggested by him or improvements suggested by the boys at the plant and approved by him.

I cannot recall a single suggestion or a single criticism made by Hyde which upon being adopted represented a permanent and positive improvement and I am quite confident that had the operation of the flotation plant been left in sole charge of Mr. Hyde it would be today in the same chaotic condition that it was in at the time I first saw the plant in October. Had Hyde been capable of producing equipment for a flotation process and of operating the equipment after it was installed there had surely been ample time and ample opportunity allowed prior to December 1st, 1912. Even though he was not given direct charge of the operations after that date, it would have still been possible for him to have designed and erected a machine of correct arrangement had he been capable of doing so.

During March and the first part of April a tremendous amount of work was done in an experimental way in order to determine every weak point in the mechanical arrangement of the plant and also to determine the exact requirements for correct flotation treatment. In this work those of us at the plant consulted no one except yourself and Mr. Janney, Jr., and while Mr. Hyde did make a few recommendations to me, I referred them to Mr. Janney, Jr., and I am free to state that I cannot recall a single one of his recommendations having been adopted except the addition of acid at the sludge tank along the lines originally proposed by Mr. Shimmin sev-
4944 eral months before that.

The design of the machines which are now operating did not seem to be along the lines desired by Mr. Hyde and so far as I know did not originate from any plans submitted by him. You will remember that you had Mr. B. A. Mitchell from the Utah plants here at the time and that he designed the gears and gear case, making

it possible to install a gear drive which did not have the objection of excessive noise which the previous installations had been burdened with. I remember that this gear case was your own idea as I was present at the conference we had in the hotel one evening when this and other matters in connection with the design of the machine *was* being taken up. The present ribbed liner for the agitation cells was of your design and I think originated from a suggestion made by Peterson and Shimmin as they had been doing experimenting with wooden baffles in the cells before your visit at that time. The spitzkastens now in use on the No. 1 rougher are remodeled spitzkastens remaining from one of the earlier machines but those on the No. 2 rougher are entirely different from anything which had been built before and entirely unlike any sketch or design which had even been submitted by Mr. Hyde. Both of these roughers have since been provided with one additional spitzkasten of the new style which has added greatly to their efficiency. The cleaner machine was provided with new style spitzkastens and the new style liners in the agitation cells.

For the first time in the history of flotation operation here
4945 we began using the system of producing a middling product on the 3d and 4th rougher cells after the remodelling. This scheme had been experimented with somewhat during March but up to that time it had to produce a rough concentrate on all spitzkastens of the rougher machine and this rough concentrate was sent to the cleaner for retreatment. Since April we have been making a middling product on all spitzkastens of the rougher machine except the first two which produce a rough concentrate for retreatment in the cleaner. The middling products from the other spitzkastens are about the same class of material as the tailings from the cleaner machine and these products are combined and returned to a tube mill for regrinding. New methods of adding oil and acid were also devised at that time and in fact the whole process was given a complete and thorough remodelling along radically different lines from anything which had heretofore been submitted. These changes were made entirely without consultation with Mr. Hyde, so far as I know, and were, for the most part, made without his knowledge. He had absolutely nothing to do with the success of the remodelling plant and from his remarks at the time he did not anticipate successful operation from the new arrangement. Since his departure from the plant, additional improvements and new methods of operation have been devised which has brought the flotation plant up to its present efficient condition, which is the production of a 50% concentrate and a recovery of 90% of the total metal content when operated in connection with the jigs and
4946 tables which is the result which Mr. Hyde stated could be obtained by the use of a process according to his plans.

So far as Shimmin and I were personally concerned, our association with Mr. Hyde was always most pleasant but even though neither of us knew anything of the flotation process at first, his advice and instruction was of very little assistance to us in obtaining a personal knowledge of flotation. I believe we all obtained more

benefit from the reading of Hoover's book on flotation than we did from association with Mr. Hyde as his advice was rather unreliable and his opinions varied from day to day and his description of mechanical arrangement rather vague so that it was difficult to arrive at any personal opinion regarding any phase of the process from the information obtained from Hyde. I know that both Shimmin and Green, as well as the operators in the plant, considered Hyde's presence detrimental and had no confidence in his ability to remedy defective conditions and I am also certain that his services were actually harmful in that he knew so little of the process as to cause his advice to be actually misleading.

Yours very truly,

F. R. WICKS,
Mill Superintendent.

F. R. W./F. T.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4947 Plaintiff's Exhibit 10.

Hayden, Stone & Co.,

Bankers,

New York-Boston.

N. B. M./K.

New York, Mar. 1, 1913.

Mr. Allen H. Rogers, c/o Butte & Superior Copper Co., Ltd., Butte, Montana.

DEAR SIR: Under date of February 6th, I received a bill from Mr. J. M. Hyde, which I am enclosing you herewith, amounting to $601.70, for expenses which I understand are in connection with the litigation of the flotation process.

In the contracts that we have with Mr. Hyde, I cannot find any reference to providing for these payments, but I understand from Mr. Babbitt that the company agreed to assume these and Hyde also points this out in previous accounts rendered in the early part of 1912, so will you kindly have instructions given for a check to be sent to Hyde, at 1041 Shattuck Ave., Berkeley, Cal., for the enclosed bill?

Yours very truly,

N. B. MACKELVIE.

4948 Butte and Superior Copper Company, Ltd.

Jan. 29, 1913.—*191–*.

Auditor:

Pay to James M. Hyde, for the items and amounts listed below:

Room & meals New York Oct. 9th to Nov. 13, 1913, incl...	$245.00
Carfare, baggage & telegrams, etc., in New York.....	17.50
Fare New York to Butte.....	75.50
Hotel, etc., Butte on return trip.....	55.50
	$393.50
Round trip Berkeley to Butte January & February, 1912..	100.00
Thornton Hotel	85.70
Incidental meals, carfare, baggage, etc.....	22.50
	$601.70

Approved.

——— ———.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4949 Plaintiff's Exhibit 11.

Butte and Superior Copper Company, Limited.

Butte, Mont., March 6, 1913.

Voucher:

Payable to James M. Hyde, $601.70 Six Hundred One and 70/100 Dollars.

Approved for Payment.

C. M. EVERETT.

Approved for Payment.

——— ———.

Details of Voucher.

As per statement of Jan. 29th, 1913 and Mr. MacKelvie's letter of March 1st.....	601.70

Entered.

Ledger.

Distribution.

Accounts Payable.

No. 5958. 601.70

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4950 Plaintiff's Exhibit 12.

Butte and Superior Copper Company, Limited.

Butte, Montana, March 6, 1913.

No. 5958.

Pay to the Order of James M. Hyde, $601.70, Six Hundred One and 70/100 Dollars.

BUTTE & SUPERIOR COPPER COMPANY, LTD.,
By C. M. EVERETT.

Special.

To the First National Bank, Butte, Montana.

(Paid Mar. 17, 1913.)

(THE FIRST NATIONAL BANK OF BUTTE MONTANA.)

(Endorsed:) Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check.

JAMES M. HYDE.

4951 Pay to the Order of Any Bank or Banker.
All Prior Endorsements Guaranteed.
First National Bank,
90-42. Berkeley, Cal. 90-42.
Mortimer, Cashier.
Mar. 11 1913.
Paid Mar 17 1913, State Savings Bank
Butte, Mont.
Paying Teller.

Pay to the Order of Any Bank, Banker or Trust Co.
Previous Endorsements Guaranteed.
Union Bank & Trust Company,
93-29. Butte, Mont. 93-29.
R. O. Kaufman, Cashier.

Pay to the Order of Any Bank or Banker.
Prior Endorsements Guaranteed. C. Mar. 11, 1913. Z.
California National Bank,
Sacramento, Calif.
Fred W., Cashier.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4952 Plaintiff's Exhibit 13.

Audit Bill.

Butte and Superior Copper Company Ltd.

Apr. 30, 1913. 191–.

Auditor:

Pay to James M. Hyde, 1041 Shattuck Ave., Berkeley, Calif., for the items and amounts listed below:

Expense account Jas. M. Hyde during months of March and April, 1913, in connection with Mill and Patent Suit as per attached $325.65

Chgd.

H. A. ATLOFF(?).

Approved:
J. L. B.

Expense Account of James M. Hyde in attendance on Mill and Patent Suit, March and April, 1913.

San Francisco to Butte and return Ticket, Pullman, Meals, etc.	$112.25
Thornton Hotel	181.90
Lunches and incidentals	18.75
Supplies, expressage, etc., in connection with suit	12.75
	$325.65

O. K.
J. L. B.

4953 Butte & Superior Copper Company, Limited.

Butte, Mont., May 2nd, 1913.

Voucher:

Payable to James M. Hyde, $325.65, Three hundred Twenty five and 65/100 Dollars.

Approved for Payment.

C. M. EVERETT.

Approved for Payment.

——— ———.

Details of Voucher.

As per expense bill of April 30th, 1913 in connection with Mill and Patent Suit..... 325.65

Entered.
Ledger.

Distribution.

Accounts Payable.

No. 6323. 325.65

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4954 Plaintiff's Exhibit 14.

Seal on car So. 15679.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit 15.

Memorandum of car.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit 16.

Bag containing concentrates.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit 17.

Bottle containing concentrates after treatment.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4955 Plaintiff's Exhibit 18.

Admitted.

Third Annual Report of Butte & Superior Company.

Part admitted and read in record and withdrawn by plaintiff.

Mr. Garrison (reading): "The litigation in connection with the Minerals Separation, Limited, which, at the date of the last annual report was pending and undecided on appeal, in the United States Circuit Court of Appeals at San Francisco, has since that time been decided in favor of your company by the Court of Appeals holding the patents of the Minerals Separation Company, Limited, as absolutely void. This question has been taken to the Supreme Court of the United States, where it is now pending, and a decision cannot reasonably be expected before some time in the spring or summer of 1916. Your directors have no reason to modify to any extent the expressions in the last annual report regarding the final outcome of this litigation. Respectfully submitted, N. Bruce MacKelvie."

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4956 Defendant's Exhibit 19.

Admitted.

Advertisement in Mining & Engineering World, December 30th, 1916. Page 12.

Mining and Engineering World.

The Flotation Process.

All rights under this process in North America are now controlled by Minerals Separation North American Corporation.

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

The Company maintains a laboratory for testing ores by flotation, and samples sent to its Chief Engineer, Mr. Edward H. Nutter, at its San Francisco address will be tested at minimum expense to prospective licensees. No one else is authorized to represent
4957 the Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Merchants Exchange Building, San Francisco, California.

61 Broadway, New York, N. Y.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit 20.

Admitted.

Copy of Mining & Engineering Journal, December 23rd, 1916. Page 35.

The Flotation Process.

All rights under this process in North America are now controlled by Minerals Separation North American Corporation.

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that

Notice is also given that the Company will enforce its patents and those who wish to install and use it.

To those who have infringed the patent, notice is given
4958 that a settlement for past infringement must precede the granting of licenses for future use of the process.

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pany or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Merchants Exchange Building, San Francisco, California.

61 Broadway, New York, N. Y.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4959 Defendant's Exhibit 21.

Admitted.

Page 55, of Salt Lake Mining Review, January 15, 1917.

The Flotation Process.

All rights under this process in North America are now controlled by Minerals Separation North American Corporation.

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of license for future use of the process.

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4960 the Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Merchants Exchange Building, San Francisco, California.

61 Broadway, New York, N. Y.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit 22.

Admitted.

Page 15 of Mining & Scientific Press, January 6, 1917.

The Flotation Process.

All rights under this process in North America are now controlled by Minerals Separation North American Corporation.

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting
4961 of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

The Company maintains a laboratory for testing ores by flotation, and samples sent to its Chief Engineer, Mr. Edward H. Nutter, at its San Francisco address, will be tested at minimum expense to prospective licensees. No one else is authorized to represent the Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Merchants Exchange Building, San Francisco, California.

61 Broadway, New York, N. Y.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit 23.

Admitted.

Page 10, Boston News Bureau, February 21, 1917.

The Flotation Process.

All rights under this process in North America are now controlled by Minerals Separation North American Corporation.

The Supreme Court of the United States having established
4962 the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

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MINERALS SEPARATION NORTH AMERICAN CORPORATION.

Merchants Exchange Building, San Francisco, California.
61 Broadway, New York, N. Y.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

4963 Defendant's Exhibit 24.

Admitted.

Page 14, New York Commercial, January 15, 1917.

Minerals Separation Flotation Process.

The flotation process for the concentration of ores is the latest and greatest invention in metallurgy. It has revolutionized the art of concentrating the ores of zinc, lead and copper. It gathers up with these metals the traces of gold and silver found associated with them and it has even entered the domain of purely gold ores. It has changed the metal values in great mounds and hills of dumps, previously rejected as worthless, into dollars and pounds sterling. It has not only reclaimed the waste of the past, but is preventing the waste of the present. The leanest ores and dumps are now made to yield their medium of values to this process on easy terms of substantial profit, and the yield from ordinary mining operations has in many instances been raised from modest earnings to fabulous profits.

Mode of Operation.

This marvellous invention utilizes little bubbles of air coursing through a muddy ore pulp of finely ground ore and water, to pick out and attach to themselves the valuable metal particles and to repel and reject the useless particles of dirt, rock or sand, or as it is generally called, gangue. The metal particles and air bubbles
4964 once united cannot be separated. Each little air bubble gathers up a load of metallic particles, and when given a reasonable opportunity will float them to and through the surface

of the pulp and form, resting upon the surface of the pulp, with other metal laden bubbles, what is in fact a water-air froth of metal carrying bubbles. Air bubbles and froth, the very symbols of things transitory and useless, have now been harnessed to the service of man as persistent and reliable agents to carry out his will in a manner bordering on the miraculous. On a quiet surface the froth persists for days. In practice the froth may be adjusted to such persistence as will assure that the froth will overflow from the top of the liquid, pushed along by constantly rising bubbles and new forming froth, and safely carrying the metallic particles into a launder or trough, ready for the smelter.

Practical Advantages.

By this process concentrates of any desired richness may be obtained, with a recovery so high that it was proved in one of the litigations involving the process that its adoption by five of the leading porphyry copper mines of the United States would effect a yearly saving at normal market prices (not war prices) of at least $17,000,000.

Ordinary Water Concentration.

The metallic particles are usually considerably heavier than
4965 the gangue particles. Therefore in the ordinary process of ore concentration advantage is taken of this fact to separate the particles by the difference in their sinking power in water. A great amount of machinery is used, principally jigs, shaking tables and vanners, all these machines depending upon this difference in sinking power. The gold miner's washing pan is the simplest example of this kind of gravity treatment. The new process, however, does the very opposite thing, it floats the heavy metallic particles above the surface of the water and permits the lighter rock or gangue particles to sink or to remain suspended in the water. It operates in fact, by picking out the heavier metallic particles and lifting them up out of the water.

History of the Invention.

The flotation process was invented in March, 1905, in London, England, at the metallurgical laboratory of Minerals Separation, Ltd. The inventors are Henry Livingstone Sulman, Hugh F. K. Picard, and John Ballot. They were investigating a concentrating process invented by Arthur E. Cattermole, wherein by using oil in the proportion of from forty to one hundred and twenty pounds per ton of ore, the metallic particles were coated with a thin sticky film of oil and by agitation they were agglutinated together into larger agglomerates or granules which would reliably sink against a current of water sufficient to carry the gangue upward and away. This metal
sinking process was in itself a great advance in the art, since
4966 it saved all the valuable metallic slimes (extremely fine particles necessarily produced in every crushing or grinding

process) which in all other then known processes were carried away to waste with the gangue. They had studied this Cattermole metal sinking process for more than two years and were then erecting a concentrating plant at Broken Hill, Australia, to carry out the process on a large scale. They had improved the Cattermole process, and in improving it they had unwittingly assembled all the conditions for the froth flotation process, even including an abundant aeration of the pulp, although that aeration was a useless incident of the violent agitation necessary for the Cattermole process as carried on in the type of agitation vessel which they used. Having developed and largely improved the Cattermole process to a working basis, they decided to carry out a series of experiments investigating all of the factors of that process, and as a part of this investigation to reduce the amount of oil step by step, observing the results and pursuing the investigation to the vanishing point. This work was carefully, systematically and well done under their instructions by one of the staff of Minerals Separation, Arthur Howard Higgins, the able metallurgist, who has since contributed largely by his inventions to the improvement of the process. As the amount of oil was diminished below Cattermole proportions, the Cattermole phenomena disappeared and no effective sinking of metal was obtained and the results were worthless. Nevertheless the reduction was persisted in, and, to the surprise of everyone a persistent metallic froth came to the surface. This, with the ore and oil used, reached its maximum in metal flotation with about two pounds of oil to the ton of ore, one-tenth of one per cent. of the weight of the ore, one part of oil to a thousand parts of ore. On examining this metallic froth it was found that the oil had disappeared from sight and touch and had lost all its ordinary qualities. Chemical investigation showed that it was upon the concentrates, but in a film, so attenuated that its presence could be detected only by chemical means. It was found that the oil when present in this minute quantity had the peculiar function of controlling the formation and action of the air bubbles so as to effect minute bubble formation and so as to assist the selective action of these bubbles for metallic particles, and so as to give practical permanency to the bubbles, both when immersed in the liquid and when gathered above the liquid in the froth.

4967

Theories of Operation.

The explanation above given is the extent of exact knowledge of the process which repeated scientific investigations have determined. The process has not yet been fully explained. Numerous theories have been advanced, and at one time electrical theories were favorably regarded, but the complete explanation of the mysterious operations is yet to come. The inventors, however, having found out how to work the process, did not wait to discover why it worked, but immediately put it to work, and the Cattermole plant in Australia was altered to carry on the new process. They also patented it practically all over the world.

4968

Metallurgical Problem at Broken Hill, Australia.

There was at Broken Hill, Australia, a great accumulation of about twelve million tons of tailings of former workings, containing about twenty-five per cent of the metal, zinc and lead, with some silver, but with the gangue of substantially the same weight as the metal. The ordinary process of water concentration, which depends upon the difference in the sinking power of the metallic and gangue particles, could do nothing with these tailings. The Cattermole process was devised to solve this metallurgical problem, and might have done fairly well but for the discovery of the vastly better flotation process.

The new process was successful from the beginning, and its use in Australia rapidly extended.

British and Australian Litigation.

A competitor who had failed to solve the problem immediately commenced suit, first in England against Minerals Separation, and then in Australia, against one of the licensees, charging infringement of the earlier Elmore patents. The process disclosed in these patents required from one to three tons of oil to the ton of ore. The metal particles were entrapped in a mass of oil and floated by the
4969 buoyancy of the oil. That there was no resemblance between this process and the new air bubble flotation or froth flotation process was finally decided, first by the British House of Lords in the suit commenced in England, and again by the Privy Council of the British Empire in the suit commenced in Australia.

The growth of the use of the new process was retarded by this litigation, and its introduction into use in America was not undertaken until after the favorable decision of the House of Lords.

Introduction into America.

Edward H. Nutter, an American mining engineer and metallurgist, was appointed Chief Engineer of the American Syndicate which undertook the work of introducing the process into use in North America. Before taking up his duties he studied the process in the London laboratories of the Company, and then went to Australia to study the extensive practical use of the process there. Early in 1911, he returned to America, organized a staff of metallurgists and commenced an active and successful campaign to bring the process to the attention of mine owners.

An American corporation has recently been formed, Minerals Separation North American Corporation, incorporated under the laws of Maryland, which now owns or controls all of the patents in North America. The directors of this Company are John Ballot, one of the inventors, who has in fact been at the head of the enterprise from the beginning; Dr. S. Gregory who has had gen-

4970 eral supervision of the work in America, and Frank Altschul, of Lazard Freres, bankers.

The process has been adopted under license from the patentees by many American mines, including the Anaconda (the greatest copper producer in the world), the Inspiration, Senator Clark's companies, the Britannia Mining & Smelting Company, Ltd., the Portland Gold Mining Company, the Vindicator Consolidated Gold Mining Company, and scores of others. The Inspiration plant is acknowledged to be the most modern of the great copper mills, and treats about 15,000 tons of ore per day and shortly will treat nearly 20,000 tons of ore per day. The installation of the flotation process at this mine effected an initial saving of more than a million dollars in the cost of installation, and has increased the capacity of the plant to more than double that of the plant originally planned at much greater cost, and has in fact converted the Inspiration mine from a moderately profitable to an enormously profitable venture. The Anaconda Company, upon adopting the process, reorganized and very nearly reconstructed its milling plant, replacing the cumbersome machinery of former processes by the simple machines of the flotation process, and increased its recoveries from 76% to 96%, while the capacity of the mill was increased from 12,500 tons to 16,000 tons per day.

Many new problems had to be worked out in applying the process to the American copper ores, and George A. Chapman, a metallurgist of Minerals Separation, Ltd., contributed several brilliant in-

4971 ventions in solving these problems. He is in fact to be credited with contributing largely to the successful installation of the process at Broken Hill, Australia, and at Inspiration and Anaconda mills in the United States.

The process has also been successfully installed at, and has proved an immense benefit to the Braden mines in Chili and the El Cobre mines in Cuba and many other mines in other parts of the world.

Infringements and Litigation.

A considerable group of American companies, notably the Jackling group of mines, determined to try out flotation without reference to the rights of the patentees. The first of these operations in defiance of the patents was carried on by the Butte & Superior Copper Company of Butte, Montana, now the Butte & Superior Mining Company, one of the Jackling group. They employed James M. Hyde, a former engineer of Minerals Separation, Ltd., for this purpose. He had been given by Minerals Separation, Ltd., all information and apparatus necessary to operate the process and sent to visit various important mines in Mexico and Canada, and while in America he was specifically instructed by Minerals Separation to go to Butte, Montana, with the object of helping the Butte & Superior Company solve its metallurgical problem. Instead of doing what he was instructed to do, he returned to London and terminated his connection with the Company. Thereafter he came back to the United States and went to the mills of the Butte & Superior Company and

there installed the flotation process. The result was the suit
4972 of Minerals Separation v. Hyde, which was commenced in October, 1911, promptly after this installation in defiance of the patents and more than five years later, on December 11, 1916, was finally decided by the Supreme Court of the United States in favor of the patentees. This suit was commenced in the United States District Court of Montana, and was there decided favorably to the patentees by Judge George M. Bourquin of that court, in July, 1913. The defendant then appealed to the United States Circuit Court of Appeals for the Ninth Circuit, sitting at San Francisco, California, and that court reversed Judge Bourquin's decision in May, 1914, and held that the patent was void. This was believed to be a final decision against the validity of the patent, and in fact the Department of Mines then announced to the mining Community that this wonderful process was now free to all. There was no right of appeal from this adverse decision, but the Supreme Court of the United States in exceptional cases reviews the decisions of the Circuit Court of Appeals in patent cases and the patentees succeeded in convincing the Supreme Court that this was a proper case for such review. In October, 1914, a writ of certiorari of the Supreme Court was issued, and the case was brought to that court for final determination, and argued and determined there as above noted.

A suit for infringement was also commenced against the Butte & Superior Company in 1913, but was held in abeyance awaiting the decision of the United States Supreme Court in the first suit.
4973 It will now be pressed to final adjudication. A suit has also been carried on against Miami Copper Company, a neighbor of the Inspiration mine, who decided to add flotation without obtaining a license, shortly after the successful demonstration of that process at the Inspiration mill. This suit was tried in Wilmington, Delaware, before Judge Edward G. Bradford. The trial occupied nine weeks, from March 29, 1915, until May 27, 1915, and was decided in favor of Minerals Separation on September 29, 1916. The important new point here involved and decided in favor of Minerals Separation, Ltd., was that flotation concentration as carried on in what are known as the Callow pneumatic cells, is an infringement of the Minerals Separation's patents. The patent of Minerals Separation for a frothing agent which is not an oil and is soluble in water was also included in this suit and was held to be valid and infringed. This case has been appealed to the United States Circuit Court of Appeals for the Third Circuit, sitting at Philadelphia, Pennsylvania, and the appeal has been set for argument late in January, the Miami Company having given a bond for $250,000 to stay injunction pending appeal.

A peculiar feature of the present situation is that the mines which have been licensed by Minerals Separation, Ltd., have paid small royalties and have themselves reaped enormous profits from additional recoveries largely at war prices, while the mines that have proceeded in defiance of the patents have run the risk of judgment against them for all of their additional profits, including their

4974 enormous war profits, attributal to the invention. The rule of law is that an infringer is to be treated as a trustee for the owner of the patent, and must account to the owner of the patent for all profits due to the invention. Further it is a fundamental principle of patent law that no one is permitted to use a patented invention without the consent of the patentees, and now that the basic patent has been finally sustained by the Supreme Court of the United States it is not to be expected that the patentees will permit the continuance of further operations in defiance of their patents.

Henry B. Williams, patent lawyer, of New York City, has conducted all of the American litigation from the beginning. William H. Kenyon of Kenyon & Kenyon, also of New York City, has been associated with him during the past two and a half years. In the Wilmington suit Thomas F. Bayard, son of late Ambassador and Secretary of State Bayard, is associate counsel. In the United States Suprme Court Lindley M. Garrison, now of New York, formerly Vice-Chancellor of New Jersey and later Secretary of War, and Frederic D. McKenney, of Washington, D. C., are associate counsel. Odell W. McConnell of Helena, Montana, and John H. Miller of San Francisco, California, have also contributed their assistance in Montana and California in the efforts to sustain the patents and secure to the inventors that protection and reward guaranteed by our patent laws.

It is to be remembered that these laws, like the copyright laws,
4975 were enacted pursuant to the clause of the Constitution of the United States empowering Congress, "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Policy of Minerals Separation.

The policy of Minerals Separation has always been, aside from its own use of its process, to license the use of its process to all who wished to use it, and to give to its licensees the full benefit of all its experience, research and knowledge, and to receive as compensation a reasonable royalty based upon material treated or values recovered by its process. Thus its compensation is based only upon the extent of the use of its process, and is quite analogous to the royalty of an author or playwright. Royalty to inventor is as much a matter of equity and good conscience as is royalty to authors. Piracy of inventions is as reprehensible as piracy of literary works.

This policy of Minerals Separation has not met with serious opposition in any part of the world except the United States. Here it has been necessary to fight to the finish to establish its rights as against many of the users of its process. Abroad it was only necessary to fight an unsuccessful competitor.

Summary of Adjudications.

Out of all this litigation have come adjudications by the three greatest courts in the world as to the novelty of the froth flo-

4976 tation process. These courts are the Supreme Court of the United States, the British House of Lords, and the Privy Council of the British Empire, the latter being a court composed in each instance of a committee appointed by the Lord Chancellor from the Law Lords of the House of Lords. In the Minerals Separation case, Viscount Haldane appointed a committee of five, including himself. The House of Lords' decision was rendered by five other Law Lords, including the then Lord Chancellor, Lord Loreburn, and the Supreme Court decision was given unanimously by the full bench of nine justices. Thus the judgments and decisions expressing the conclusions of nineteen of the greatest jurists in the world. It is pleasing to note that the opinions of Judge Bourquin of Butte, Montana, and Judge Bradford, of Wilmington, Delaware, are in harmony with these great courts and were in fact followed by the Supreme Court of the United States. It is believed that the legal battle as to the rights of the inventors is now substantially completed.

Adjudications as to the Novelty of the Invention.

It has been repeatedly stated in the literature of flotation that Carrie J. Everson was the inventor of flotation. The fact is that her patent of 1886, discloses a metal-sinking process, in which the metallic particles are mixed with enough oil to make them lighter than gangue, but still heavier than water, and are separated in
4977 suspension by reason of the fact that they do not sink as fast as the gangue. To use her own words: "The sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil and acid."

Her patent has now been considered both by the House of Lords and the Supreme Court of the United States, and the Supreme Court of the United States has agreed with the House of Lords that her patent does not disclose flotation. The following is an excerpt from the Supreme Court decision:

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force that separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than, and different from, that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical. It results without more discussion that we fully agree with the decision of the House of Lords, arrived at upon a different record and with different witnesses, but when dealing with the equivalent of the patent in suit, in

4978 Minerals Separation, Limited, v. British Ore Concentration Syndicate, Limited, 27 R. P. C. 33. In this decision Lord Shaw, speaking for the court and distinguishing the process there in suit especially from the Elmore oil flotation process which had gone before, but which was typical of the then prior art said: "They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid.

"And Lord Atkinson said: 'In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of the air bubbles, which, introduced into the mixture by the more or less violent agitation of it, enveloped or becomes attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water.'

4979 "The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining companies of the world, notably in the United States, Australia, Sweden, Chile and Cuba, and that, because of its economy and simplicity, it has largely replaced all earlier processes. This, of itself, is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect."

The Supreme Court of the United States and the Privy Council of the British Empire, have both considered the Criley and Everson publication in the Engineering and Mining Journal of 1890. The Privy Council said that their attention had been directed in considerable detail to this article and they found it so incomplete that it was not even sufficient to anticipate the Elmore patent (although the House of Lords had held the British Elmore patent anticipated by the Everson patent). They said of it:

"Even if the test process is not to be discarded as a failure, it does no more than give information that if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in sufficient quantity, in some way a differentiation is effected as between the metal and the gangue."

4980 To Carrie J. Everson is to be given the credit of having first discovered that in a process where oil is used to entrap

the metal of an ore pulp and add buoyancy to it, an acid such as sulphuric acid will help to keep the oil off the gangue. In her patent she did not add enough oil to make the metal float. In what is described in the publication above referred to she may have done so, but the publication itself does not establish that fact. If she did, she completely anticipated the Elmore oil-buoyancy metal-flotation process, but was no nearer the froth flotation process than was Elmore with his minimum of a ton of oil to a ton of ore.

The other prior patents which have been relied upon to anticipate the froth flotation process are all disposed of by the decision of the Supreme Court of the United States. As that court says of all prior processes, including Everson:

"All of which, speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil * * * and then in variously treating the mass—'the pulp'—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue."

As otherwise expressed in the decision, before the froth flotation process was invented, oil was loaded with metal, and either floated the metal, as in Elmore, by what the Supreme Court calls the "Surface Flotation Process," or sank the metal, as in Cattermole, by what the Supreme Court call the "Metal Sinking Process". Everson, so far as disclosed in the patent, comes within the latter class.

4981

As contrasted with the utilization of oil as a buoyant agent or as an agglutinating agent, the froth flotation process utilizes air bubbles as the buoyant agent and only utilizes oil to modify the air bubbles and make them persistent and increase their adherence to the metallic particles. The oil disappears from sight and touch, and the apparatus, except at the point of the introduction of the oil, remains as clean and as free from oil as though no oil were used.

In Australia Minerals Separation and licensed users have produced by flotation over 1,800,000 tons of zinc, 350,000 tons of lead, and 40,000,000 ounces of silver.

Extent of Use of the Invention.

The following are among the principal licensees under Minerals Separation patents in North America:

Atlas Mining & Milling Co.
M. W. Atwater.
Anaconda Copper Mining Co.
Arizona Copper Co., Ltd.
Britannia Mining & Smelting Co., Ltd.
Burro Mountain Copper Co.
Broadwater Mills Co.
Brockmann & Co., Inc.
Cuba Copper Co.
Cusi Mining Co.
Consolidated Arizona Smelting Co.

Chicagoff Mining Co.
4982 Doe Run Lead Co.
Desloge Consolidated Lead Co.
Dutch-Sweeney Mining Co.
Engels Copper Mining Co.
Flint Mines, Ltd.
Greene-Cananea Copper Co.
Highland Valley Mining & Dev. Co.
Inspiration Cons. Copper Co.
Mountain Copper Co., Ltd.
Mond Nickel Co., Ltd.
Mineral Recovery Co.
Old Dom. Cop. Mining & Smelting Co.
Pingrey Mines & Ore Reduction Co.
Phelps, Dodge & Co.
Portland Gold Mining Co.
Reward Gold Mines Co.
St. Joseph Lead Co.
Timber Butte Milling Co.
Utah Leasing Co.
Vindicator Cons. Gold Mining Co.
Weedon Mining Co., Ltd.

In North America, and principally in the United States, the use of the process has been carried on both by licensees and infringers. It is estimated that over 1,000,000 tons of ore were treated by the process during 1914, 5,000,000 tons during 1915, and about 25,000,000 tons during 1916.

In South America the Braden Copper Co. is the largest user of the Minerals Separation flotation process. The Cerro de Pasco
4983 Mining Co., Corocoro United Copper Mines, Ltd., and the Societe des Mines de Cuivre de Caternau are also South American licensees.

There are also several licensees in Europe, but no statistics are available because of the war.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit 25.

Admitted.

Henry D. Williams,

Attorney and Counsellor at Law.

Solicitor of Patents.

61 Broadway (Adams Building).

New York, January 30, 1917.

Utah Copper Company, 600 McCormick Building, Salt Lake City, Utah.

GENTLEMEN: In behalf of my clients, Minerals Separation, Limited, of London, England, and Minerals Separation North American Corporation of 61 Broadway, New York, N. Y., you are hereby notified of infringement of my clients' patents for froth flotation concentration of ores, and particularly the basic patent for such a process, No. 835,120, issued November 6, 1906, to Sulman, Picard and Ballot, recently held to be valid and infringed by the
4984 Supreme Court of the United States in the case of Minerals Separation, Ltd., and another against Hyde. I am enclosing a copy of the opinion and order of the Supreme Court and of the decree and injunction affirmed thereby with immaterial modifications. My clients are willing to grant licenses to those who wish to use their inventions, but before any consideration can be given to that matter, a full settlement for past infringements must be made, and this altogether regardless of whether or not you wish to continue to use flotation.

You are therefore hereby directed to send to me a full statement of your infringing operations in accordance with the interrogatories enclosed herewith, in default whereof I am directed to commence suit against you for an injunction, profits and damages, including a preliminiary injunction at the commencement of the suit to immediately stop your infringing operations.

Yours, etc.,

(Signed) HENRY D. WILLIAMS.

2 encs.

Enclosed in letter from John M. Hays, dated Feb. 7, 1917.

Statement of Flotation Operations.

1. Name of company.
2. Where incorporated.
3. Home office address.

4985 4. Name of mine.
5. Mine address.
6. (*a*) Is mine in operation?
(*b*) Is mill in operation?
7. (*a*) Present daily tonnage.
(*b*) Expected daily tonnage.
8. General character of ore.
9. Principal sulphide minerals.
10. Principal gangue minerals.
11. Type and daily capacity of milling plant.
12. (*a*) Is the flotation process in use or has it been used, experimentally or otherwise, in this mill?
(*b*) For how long?
13. What products are or have been treated by flotation?
14. What is the total mill recovery?
15. What proportion of total recovery is due to flotation?
16. Number of tons treated daily by flotation.
17. Total tonnage treated by flotation to date.
18. Total concentrates produced by flotation to date.
19. Average assay value of flotation concentrates.
20. Gross market value of all flotation concentrates produced to date in this mill.
21. Type and manufacture of flotation apparatus used in this mill.
22. (*a*) Have any flotation tests been made on this ore?
(*b*) If so, by whom?
4986 23. On separate sheet, give complete details of flotation tests made.
24. Remarks.
Dated.
Signed.
Title.

B.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Defendant's Exhibits Nos. 26 to 32, inclusive, marked pages 4987-90, 4992-95, and 4997.)

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Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.

Defendant's Exhibit No. 26.

CHINO COPPER COMPANY
HURLEY PLANT

Admitted as part enclosed

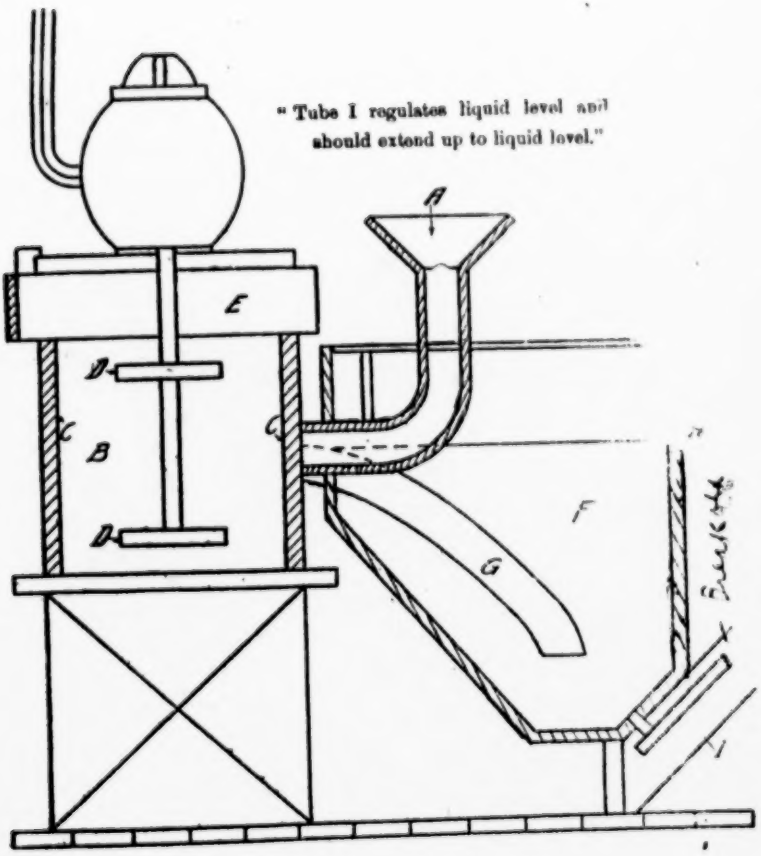
Record of Flotation Operations on the Retreatment of Vanner Concentrate

Date	FLOTATION HEADINGS			FLOT. CONCTS.		Flot. Tails		Actual Oz. Recovered per Ton	Other Recovery per Ton
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	Assay Percent Copper	% Indicated Recovery		
1914									
Dec. 8 to 31	2,003	105	13.19	588	42.87	.959	94.851	2.45	Nil
1915									
1st Quarter	12,531	139	12.62	3,512	41.30	.776	95.648	2.87	1.30
2d "	26,496	291	9.64	6,312	37.76	1.362	89.084	1.51	.292
3d "	31,781	345	7.33	6,587	31.69	.850	90.812	1.48	.594
4th "	24,587	267	6.47	4,713	32.29	.581	92.688	2.18	2.350
Year 1915	95,395	261	2.02	21,223	35.99	.89	92.42	2.01	.900
1916									
1st Quarter	26,800	298	6.17	6,604	24.14	.392	95.193	5.95	3.629
2nd "	26,329	286	7.12	6,099	29.78	.391	95.766	10.97	6.191
3d "	26,804	291	7.01	6,804	27.10	.306	96.717	8.76	4.570
Oct. 1916	9,794	316	7.77	2,884	26.03	.20	98.17	10.26	4.768
Nov. 18, 19, 20	551	187	10.24	190	29.28	.244	98.437	23.70	6.338
Nov. 1916	8,444	281	7.78	2,612	23.91	.32	97.19	13.71	4.774
Dec. 1 to 20	5,570	279	8.48	2,099	21.62	.412	96.989	12.39	4.348
Dec., 21 to 31	2,130	194	9.24	948	20.37	.332	98.004	24.57	6.178
Dec. 1916	7,800	252	8.79	3,046	21.48	.39	97.33	16.77	4.85
4th Quarter	26,047	283	8.08	8,542	23.76	.292	97.585	13.33	4.798
Year 1916	105,980	290	7.14	28,045	26.52	.35	96.37	10.24	4.791
1917									
January	6,518	210	8.09	2,259	23.24	.29	97.63	21.10	6.458
February	5,614	201	7.64	2,030	21.29	.29	97.53	21.70	6.753
March	8,265	267	5.23	2,230	18.49	.39	94.54	23.73	6.348
1st Quarter	20,397	227	6.81	6,519	21.01	.32	96.77	22.18	6.520
Dec. 8, 1914 to Dec. 20, 1916	201,139	272	8.04	48,870	30.61	.48	95.528	5.98	4.190
Dec. 21, 1916 to Mar. 31, 1917	22,536	223	7.04	7,447	20.93	.32	96.936	23.38	6.349
All Operations up to Mar. 31, 1917	223,775	266	7.97	56,375	29.62	.632	94.078	9.219	2.053

Hurley 4/2/17
Copied Butte 4/15/17

(Signed) F. R. WICKS
Asst. Supt. of Mills.

Defendant's Exhibit No. 27.



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Filed May 18 1917 GEO. W. SPROUL, Clerk
By H. H. WALKER, Deputy.

CHINO COPPER COMPANY

HURLEY PLANT

Record of Flotation Operations On the Treatment of Slime Vanner Tailings

Date	FLOTATION HEADINGS: Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	FLO. CONCTS.: Weight Dry Tons	Assay Percent Copper	Flotation Tails: Assay Percent Copper	Flotation Tails: % Indicated Recovery	Initial Oil Pounds Per Ton	Other Reagents Pounds Per Ton	Oil In Asso'd Load Lbs. Per Ton	Total Oil Pounds Per Ton*	Kind of Oil Used
1915												
Apr. 16-30	5600	410	.90	157	12.78	.74	24.33	.85				
May 1-25	27750	1110	.93	595	11.14	.73	23.01	1.08				
June	None											
July 13-23	8065	733	.74	434	4.90	.54	30.37	1.45				
3d Quarter	90104	979	.72	1353	16.93	.47	35.35	1.20				
4th "	299522	3256	.78	20842	23.08	.54	35.72	1.02				
Year 1915	434041	1189	.798	23283	22.060	.540	33.14	1.04				
1st Quarter	288320	3168	.68	3915	21.27	.67	25.92	1.04				
2d "	280424	3048	.79	2846	27.03	.54	33.43	1.45				
3d "	328120	3566	.86	3516	28.07	.53	35.94	1.33				
4th "	352810	3835	.82	3668	29.53	.32	37.59	.96				
Year 1916	1249674	3414	.81	13945	26.48	.56	33.27	1.19				
Jan. 1917	127350	4108	.75	1204	31.89	.45	40.49	1.10				
Feb. 1917	124900	4461	.78	1177	28.78	.51	35.23	.53				
Mar. 1917	136170	4393	.71	1453	25.22	.44	37.89	1.46				
1st Quatrer	388420	4269	.75	3834	28.63	.47	37.87	1.03				
Aver. of All Operations to Date	2072135	2999	.814	41062	24.175	.539	34.553	1.13				
1917												
Jan. 7	2098		.98		22.47	.78	24.07	9.72		*2.43	12.15	James Stove*
Mar. 13	205		.67		9.10	.53	25.50	24.19				Coal Tar
Mar. 14	122		.50		27.60	.48	41.00	22.80				& Stove
Mar. 21	135		.69		25.10	.44	37.00	37.79				Taft
Mar. 27	2300		.63		11.73	.41	36.20	32.27				Sulphur
Apr. 2	1700		.61		14.87	.43	30.40	10.54				
Apr. 2	1963		.65		14.87	.48	27.00	.34				
Apr. 4	3250		.57		25.73	.40	30.30	8.10		3.2	11.3	

*Approximate quantity.

Hurley 4/10/17
Copied Butte 4/15/17

(Signed) O. WISER
Metallurgical Engineer

Butte & Superior Mining Company.

Defendant's Exhibit No. 28.

4189

CHINO COPPER COMPANY
HURLEY PLANT
Record of Flotation Operations On the Retreatment of Vanner Concentrates

DATE	FLOTATION HEADINGS			FLOTATION CORCTS.		FLO. TAILS	% Indicated Recovery	Initial Oil Pounds Per Ton	Other Re-Agents Pounds Per Ton
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	Assay Percent Copper			
1914									
Dec. 8 to 31	2,005	105	13.19	58b	42.87	.959	94.851	2.45	Nil
1915									
1st Quarter	12,531	139	12.62	3,512	41.30	.776	95.648	2.87	.130
2nd Quarter	26,496	291	9.64	6,312	37.76	1.362	89.084	1.54	.292
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Year 1915	95,395	261	9.82	21,223	35.99	.89	92.42	2.01	.900
1916									
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2nd Quarter	26,329	286	7.12	6,059	29.78	.591	95.766	10.97	6.191
3rd Quarter	26,804	291	7.01	6,804	27.10	.306	96.717	8.76	4.570
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Dec. 1916	7,809	252	8.79	3,046	21.48	.39	97.33	16.77	4.86
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1st Quarter	20,397	227	6.81	6,519	21.01	.32	96.77	22.18	6.520
Dec. 8, 1914 to Dec. 20, 1916	201,139	272	8.04	48,876	30.61	.48	95.528	5.98	4.190
Dec. 21, 1916 to Mar. 31, 1917	22,536	223	7.04	7,467	20.93	.32	96.936	23.38	6.349
All operations up to Mar. 31, 1917	223,775	266	7.97	56,375	29.62	.612	94.075	9.219	2.053

(Signed) F. R. WICKS
Asst. Supt. of Mills.

Hurley, N. Mex.
April 2. 1917.

Filed May 18, 1917 GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 30.

UTAH COPPER COMPANY—ARTHUR PLANT

Flotation Retreatment Plant Results—Treating Mineral Classifier Overflow
February 1, 1915 to April 8, 1917—Inclusive

Month	Estimated Tons Treated	HEADING Cu	HEADING Fe.	HEADING Insol.	Tailing	Tons Conct. Produced	CONCENTRATE Cu.	CONCENTRATE Fe.	CONCENTRATE Insol.	% Ind. Ext'n	Ratio Conct.	POUNDS PER TON Oil	POUNDS PER TON Reagents	Per Cent Solids
1915														
Feb.	10,204	9.320	6.97	72.44	.370	3001.2	30.760	19.78	16.46	97.20	3.40	2.27	4.68	42.30
March	12,016	3.087	7.21	72.13	.419	3433.2	27.248	22.04	16.00	96.30	3.50	1.54	5.85	41.29
April	14,150	7.200	7.48	73.16	.260	3834.7	25.890	23.79	16.02	97.37	3.69	1.64	9.51	38.44
May	16,252	8.850	7.34	71.38	.250	4880.5	28.920	21.13	15.82	98.02	3.33	1.83	2.83	38.95
June	16,847	7.380	7.06	72.78	.330	4254.3	28.230	20.32	18.22	96.66	3.96	1.90	2.34	40.56
July	17,716	8.650	7.76	69.93	.570	5714.8	25.580	20.70	19.65	95.54	3.10	2.88	1.98	28.80
August	17,664	10.050	7.38	69.10	.560	5888.0	29.070	18.67	19.37	96.28	3.00	2.48	2.43	26.85
Sept.	16,605	8.914	8.49	67.33	.549	5667.2	25.032	20.71	19.91	95.94	2.93	3.19	2.07	28.14
October	16,547	9.162	6.68	71.82	.300	4838.3	30.571	19.67	16.29	97.69	3.42	8.94	1.80	23.09
November	16,405	8.831	8.22	68.99	.219	5047.7	28.186	21.33	15.75	98.28	3.25	4.25	2.39	25.89
December	15,719	8.487	6.90	72.54	.409	4478.3	28.775	20.40	16.19	96.55	3.51	3.50	2.94	24.94
1916														
January	14,213	8.114	5.60	74.79	.259	3518.1	32.025	19.12	15.33	97.60	4.04	4.34	2.03	20.37
February	13,403	7.053	5.43	76.61	.301	3025.5	30.190	20.69	14.45	96.69	4.43	4.26	2.64	19.41
March	15,799	6.041	5.03	79.65	.316	3230.9	28.304	22.08	14.55	95.84	4.89	3.61	2.32	25.24
April	17,331	6.034	5.02	78.23	.354	3727.1	26.746	21.60	16.77	95.40	4.65	3.21	2.95	24.59
May	20,334	7.107	6.18	75.14	.365	5295.3	26.254	21.88	17.48	96.20	3.84	2.66	3.98	24.63
June	24,759	6.811	6.83	73.28	.381	6954.8	23.285	23.07	18.25	95.97	3.56	2.71	3.65	25.45
July	26,024	6.899	6.03	75.79	.471	7169.1	23.828	20.88	21.98	95.05	3.63	3.67	4.51	27.68
August	27,436	7.104	7.26	73.29	.357	7728.5	24.305	22.50	18.25	96.39	3.55	4.42	5.25	23.87
Sept.	27,183	7.219	6.57	74.38	.338	7406.8	25.615	22.71	16.62	96.59	3.67	4.84	5.27	29.15
October	25,918	7.150	6.21	74.54	.275	6662.7	27.030	22.53	15.32	97.14	3.89	5.00	7.25	32.86
November	23,685	6.751	6.73	73.96	.284	6151.9	25.173	24.24	15.18	96.89	3.85	5.52	7.09	31.52
Dec. 1 to 21, incl.	14,076	6.749	5.99	75.12	.380	3590.8	25.355	22.90	19.16	95.80	3.92	5.21	7.21	27.44
Total	420,285					115499.7								
Average		7.625	6.70	73.43	.361		26.800	21.53	17.34	96.57	3.64	3.76	4.05	28.43

USING 20 POUNDS OF OIL PER TON OF ORE TREATED

Month	Tons Treated	HEADING Cu.	HEADING Fe.	HEADING Insol.	Tailing	Tons Conct. Produced	CONCENTRATE Cu.	CONCENTRATE Fe.	CONCENTRATE Insol.	% Ind. Ext'n	Ratio Conct.	POUNDS PER TON OILS New	OILS Circ.	OILS Total	Reagents	Per Cent Solids
Dec. 22 to 31, incl.	2,321	4.908	3.98	81.82	.199	433.0	25.713	19.38	21.75	96.69	5.36	23.95		23.95	9.90	26.00
1917																
January	17,905	5.288	5.14	78.77	.172	3858.8	24.153	21.58	18.85	97.44	4.64	19.73	1.02	20.75	5.04	28.94
February	17,962	5.806	5.81	76.59	.223	4457.1	22.733	20.76	22.58	97.11	4.03	15.39	2.91	18.30	5.51	29.09
March	19,937	5.189	6.04	77.22	.228	4862.7	20.712	22.09	21.70	96.67	4.10	15.33	4.93	20.26	6.35	30.71
April 1-8	5,051	4.928	6.89	76.39	*.586	1220.0	18.546	21.99	22.36	90.98	4.14	39.13	6.26	45.39	7.40	29.13
Total	63,176					14831.6										
Average		5.361	5.71	77.38	.238		22.180	21.47	21.28	96.60	4.28	18.81	3.17	21.98	5.96	29.45

* The high tailing obtained from April 1st to 8th, 1917, inclusive, was due to extensive experimenting with oils.
One machine in operation February 1st, 1915 to July 11th, 1916, inclusive.
Two machines in operation July 12th, 1916 to April 8th, 1917, inclusive

Arthur, Utah.
April 21, 1917.

Copied Aug. 13th, 1917.
Butte, Mont.—MCD

Filed May 16, 1917 GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 31.

UTAH COPPER COMPANY—ARTHUR PLANT
EXPERIMENTAL AND RESEARCH DEPARTMENT
Summary of Results Obtained from Commercial Experiments on Low Grade Concentrate

Exp. No.	Hours Duration	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % Insol.	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE Insol.	Ratio Conct.	% Ind. Ext's	% Solids in Feed	Tons Circ. Feed	Tons Total Feed	POUNDS NEW OIL ADDED Total Pounds	Per Ton New Feed	Per Ton Total Feed	CIRCULATING OIL Total Lbs.	Per Ton New Feed	Per Ton Total Feed	TOTAL NEW AND CIRCULATING OIL Total Pounds	Per Ton New Feed	Per Ton Total Feed	FLOW CELLS To Bins	To Circ.	REAGENTS Total Pounds	Pounds Per Ton
USING 59% SMELTER FUEL, 30% JONES, 10% AMERICAN CREOSOTE NO. 2, 1% YARYAN PINE																													
1	8	151	4.500	7.40	76.20	124.7	1.577	26.3	18.325	28.10	11.90	5.73	71.07	30.35	23	174	242	1.60	1.39	953	6.31	5.48	1195	7.91	6.87	7	21	1532	10.14
2	24	638	4.700	6.53	77.20	502.3	1.066	135.7	18.158	25.75	16.28	4.70	82.14	30.94	82	720	2394	3.75	3.33	3951	6.19	5.49	6345	9.94	8.82	6	22	5796	9.08
3	24	594	4.216	6.60	75.93	452.2	.456	141.8	16.209	25.33	17.78	4.19	92.43	28.69	102	696	4419	7.44	6.35	3869	6.51	5.56	8288	13.95	11.91	7	21	4288	7.22
4	24	697	5.433	6.03	75.80	523.3	.324	173.7	20.818	22.87	20.14	4.01	95.52	30.25	114	811	6863	9.85	8.46	4920	7.06	6.07	11783	16.91	14.53	9	19	4824	6.92
5	24	652	4.700	6.97	76.53	490.7	.226	161.3	18.321	25.81	16.51	4.04	96.38	28.40	110	762	8031	12.32	10.54	4579	7.02	6.01	12610	19.34	16.55	7	21	3752	5.75
6	24	627	4.733	6.87	76.20	471.8	.141	155.2	18.692	24.50	18.77	4.04	97.76	27.65	89	716	9418	15.02	13.15	5596	8.93	7.82	15014	23.95	20.97	7	21	3752	5.98
7	24	597	3.833	6.27	79.00	478.1	.076	118.9	18.950	23.69	19.39	5.02	98.41	26.43	75	672	12133	20.33	18.06	5000	8.37	7.44	17133	28.70	25.50	6	22	3216	5.39
8	16	278	4.00	5.65	80.20	213.2	.251	64.8	16.325	24.95	17.40	4.29	95.19	17.45	51	329	9210	33.13	27.99	2514	9.04	7.64	11724	42.17	35.63	7	21	3828	13.77
9	24	731	4.166	7.10	74.40	553.1	.119	177.9	16.764	22.26	23.20	4.11	97.84	33.11	106	837	26614	36.41	31.80	3896	5.33	4.65	30510	41.74	36.45	12	16	6331	11.07
10	16	438	3.900	6.95	75.60	323.3	.100	114.7	14.600	24.93	21.83	3.82	98.11	26.83	58	496	15514	35.42	31.28	2694	6.15	5.43	18208	41.57	36.71	8	20	4829	11.03
11	24	572	4.500	7.30	75.47	425.7	.166	146.3	17.099	22.14	22.24	3.91	97.26	27.24	74	646	34060	59.55	52.72	4311	7.53	6.67	38371	67.08	59.39	10	18	6331	11.07
12	24	693	5.933	6.80	75.00	473.7	.268	219.3	18.169	18.87	27.62	3.16	96.91	29.94	92	785	45008	64.95	57.33	5172	7.46	6.59	50180	72.41	63.92	14	14	3885	5.61
13	24	643	5.300	7.53	76.53	452.8	.272	190.2	17.250	19.61	25.76	3.38	96.39	31.23	123	766	66512	103.44	86.83	7375	11.47	9.63	73887	114.91	96.46	12	16	6364	9.90
USING 91% AMERICAN CREOSOTE NO. 2 AND 9% YARYAN PINE																									Refer to Exp. ↘					
14	2	53	4.500	7.50	77.60	49.0	3.433	4.0	17.400	25.80	16.20	13.09	29.54	27.04	6	59	36	.68	.61							1	9	19	368	6.94
15	8	218	5.100	6.40	77.20	186.5	2.460	31.5	20.700	26.15	14.00	6.91	58.75	30.18	46	264	213	.98	.81							3	9	9	1398	6.41
16	8	244	5.600	7.40	75.80	185.6	.740	58.4	21.050	27.30	10.40	4.18	89.95	31.09	32	276	364	1.49	1.32							4	7	21	1205	4.94
17	8	181	4.500	8.00	76.20	143.5	.810	37.5	18.650	27.87	12.20	4.83	85.72	23.64	21	202	356	1.97	1.76							5	11	17	1282	7.08
18	4	120	5.500	6.20	76.60	106.5	3.502	13.5	21.250	25.85	16.25	8.88	43.49	30.15	16	136	129	1.08	.95	151	1.25	1.11	280	2.33	2.06	6	8	20	636	5.30
19	4	147	5.950	5.50	76.80	114.8	1.217	32.2	22.850	24.40	16.00	4.57	84.02	28.57	22	169	261	1.78	1.54	343	2.33	2.03	604	4.11	3.57	8	8	20	777	5.29
USING 60% SMELTER FUEL AND 40% JONES OIL																													
20	24	628	4.716	5.86	78.46	478.5	.306	149.5	18.812	19.69	26.13	4.20	95.06	26.70			11206	17.84								28		3885	6.19

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 32.

UTAH COPPER COMPANY—ARTHUR PLANT
EXPERIMENTAL AND RESEARCH DEPARTMENT
Summary of Returns Obtained from Commercial Experiments On Slime Feed

Exp. No.	Hours Duration	HEADING Dry Tons	HEADING % Cu.	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Insol.	Ind. Ext'n	Ratio Conct.	POUNDS PER TON Oil	POUNDS PER TON Acid	
USING 98 PERCENT { 60 Per Cent 34° Paraffine Base Distillate 40 Per Cent Gilsonite } 2 Per Cent { 95 Per Cent Barrett No. 4 Creosote 5 Per Cent Yaryan Pine }														
21	8	284.0	1.450	268.2	.180	15.8	22.600	14.50	34.20	88.11	17.94	10.15	7.42	
22	8	238.0	1.045	230.1	.475	7.5	17.700	13.800	38.00	56.05	30.22	11.36	7.44	
23	8	252.0	1.485	234.4	.310	17.6	17.100	12.80	39.60	80.59	14.29	15.32	6.67	
24	8	230.0	.970	221.3	.180	8.7	21.000	16.50	29.00	82.15	26.35	20.19	8.46	
25	24	611.0	1.030	576.1	.180	34.9	15.433	14.66	40.00	83.83	17.53	20.69	8.11	
26	8	174.0	.980	166.3	.170	7.7	18.500	18.10	31.20	83.42	22.63	39.26	17.33	
27	8	260.0	.700	250.8	.110	9.4	16.400	12.70	42.00	84.85	27.61	56.93	6.46	
28	4	137.5	.940	129.4	.100	8.1	14.300	8.90	50.90	89.99	16.90	78.40	7.40	
29	4	137.5	1.060	128.7	.110	8.8	15.090	12.40	41.00	90.28	15.67	99.43	7.40	
USING { 95 Per Cent Barrett No. 4 Creosote 5 Per Cent Yaryan Pine }														
30	16	526.0	1.085	516.9	.995	9.1	5.200	6.30	69.70	9.88	57.83	.48	5.62	Refer to Experiment No. 25
31	8	307.0	1.020	306.4	1.015	.6	3.450	5.00	74.60	.69	487.00	.53	6.20	" " " " 26
32	8	202.0	.875	194.4	.760	7.6	3.800	5.40	74.40	16.46	26.43	.95	10.43	" " " " 27
33	8	205.0	.790	204.9	.780	.1	17.200	12.00	44.00	1.33	1642.00	1.57	9.26	" " " " 28

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

4998 Plaintiff's Exhibit No. 33.

T. A. JANNEY.

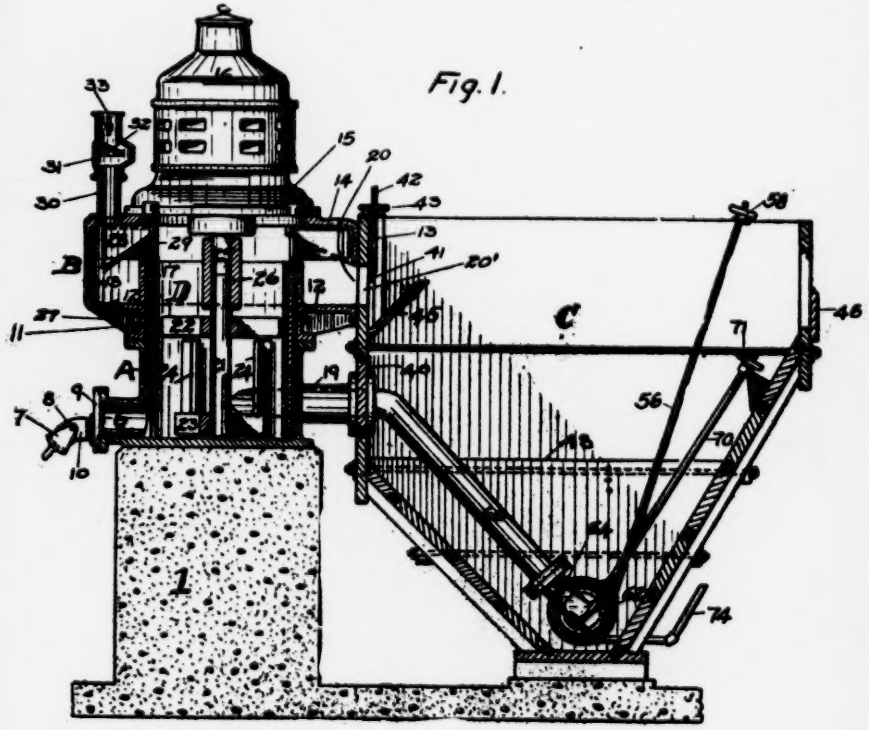
ORE CONCENTRATING APPARATUS.

APPLICATION FILED AUG. 10, 1914.

1,167,076. Patented Jan. 4, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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APPLICATION FILED AUG. 10, 1914.

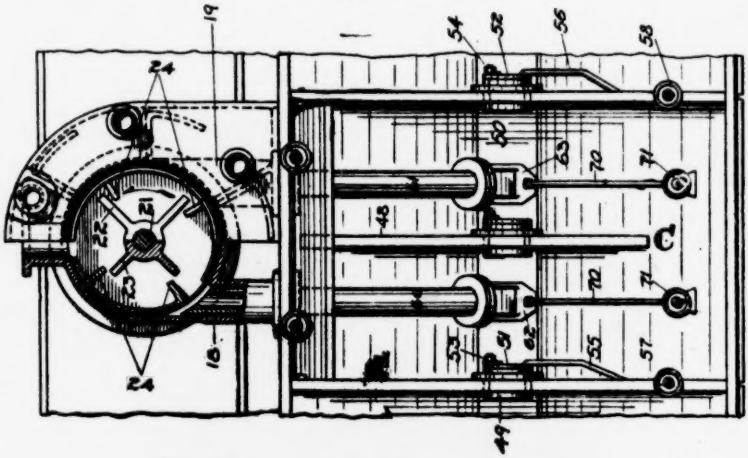
1,167,076.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 2.

1999

Fig. 2



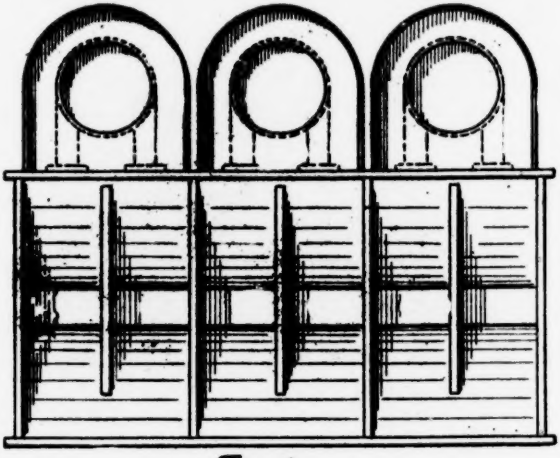


Fig. 4.

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APPLICATION FILED AUG. 10, 1914.

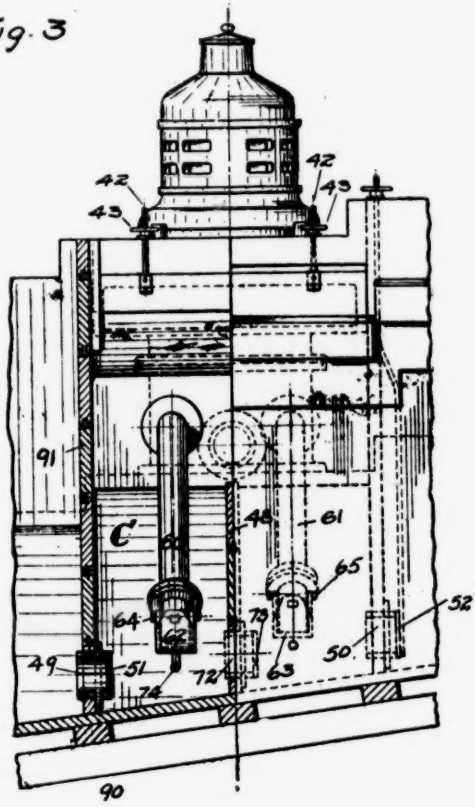
1,167,076.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 3.

5639

Fig. 3



WITNESSES:

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UNITED STATES PATENT OFFICE.

5001 THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

1,167,076. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed August 10, 1914. Serial No. 856,092.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus, of which the following is a specification.

The object of my invention is to provide an improved apparatus for carrying out flotation processes of concentrating ores.

The apparatus herein described and claimed is of the same general type as that set forth in my copending application, Serial No. 833,973, filed April 23, 1914, in that its operation involves repeated circulation of the ore pulp in each unit of the apparatus, but differs in the simplification of the connections between different units of the apparatus when arranged in series, thus economizing space, simplifying construction, and giving a more direct flow of the pulp from one unit of the apparatus to the next.

Another improved feature of the apparatus herein described and claimed is the use of an agitating vessel of less depth than, and arranged on a higher level than the related separating box or spitzkasten of the same unit. The shallower agitating vessel leads to a great economy in power by reason of the fact that the agitating blades are submerged under a much less head of liquid and hence impart the requisite stirring while working against a much decreased pressure, and at the same time the necessary depth of the separating box is maintained, thus giving ample opportunity for separation of the floating and sinking constituents and preventing disturbance of the floating material by the currents caused by removal of pulp from the bottom of the box.

The particular object and nature of my invention, and the scope thereof, will more fully appear from the following description, and the accompanying drawings of one form of apparatus embodying the same.

In the drawings, Figure 1 is a vertical section through the agitation vessel and the connected separating box. Fig. 2 is a plan view partly in section to more fully show the construction. Fig. 3 is an elevation of the apparatus, partly in section, from the right hand side of Fig. 1. Fig. 4 is a diagrammatic plan view of several units of the apparatus connected in series.

The apparatus rests upon a foundation 1 having an elevated pedestal to support the agitating vessel D at a higher level than the separating box C.

The agitating vessel in the particular form of the device illustrated, consists of two main castings, A and B, the former resting upon the foundation *l*. In the lower casting A at the bottom of the agitation vessel, I provide a drainage spout 6 to which is fitted a valve consisting of plate 9 secured to the end of spout E, tubular extension 10, and valve member 7 pivoted at 8 and adapted to control the outlet from the bottom of the agitation vessel. In operation the drainage spout 6 is closed and is opened only for the purpose of flushing out the apparatus when shut down for repairs or otherwise.

The upper casting B of the agitation vessel comprises a lower cylindrical part 11, seated on the lower casting 4, an outwardly extending substantially horizontal part 12, from which there extends upwardly the part 13, which is closed at its upper end by the inwardly extending top flange 14 and by the base 15 of the motor casing 16. The part 13, as shown in Fig. 2, is cylindrical in form on the side away from the spitzkasten, but rectangular on the side adjoining and communicating with the spitzkasten. A cylindrical lining 17 extends from the bottom of the main chamber of the agitation vessel to a point considerably above the outward projection 12 of the upper casting B, the lining being apertured opposite the spout 6, and opposite the ducts 18, 19 which form part of the lower casting and communicate with the separating box C.

The enlarged part 13 of the upper part of the agitation vessel is provided on the side thereof adjacent the separating box with an outlet opening 20 through which the pulp after being agitated and thrown upwardly over the upper edge of the lining 17, may flow to the separating box C.

The shaft 25 of an electric motor within the casing 16 is detachably connected to the agitator shaft 21 by a coupling 26, and two agitators 22 and 23, each consisting of four radial arms, are secured to the shaft 21. Projecting inwardly from the lining 17 of the agitation vessel D, are ribs or baffles 24, the arms of the lower agitator 23 being shorter than those of the upper agitator 22 in order to just clear the baffles and just

clear the inner surface of the lining 17. The upper casting B of the agitation vessel D is strengthened by braces 27 and 28 which are cast integral therewith. Liner plates 29, are bolted or otherwise secured to the braces 28 on the side thereof against which the pulp is thrown by the agitator. In the present instance the agitator is designed to revolve in the direction indicated by the arrow in Fig. 2. The braces 28 and liner plates 29, perform the additional function of preventing the pulp, which is thrown upwardly and outwardly by the agitator, from escaping through the air inlet pipes 30, which extend upwardly from openings in the top 14 of the agitation vessel, the upwardly extending pipes themselves forming an additional safeguard against escape of pulp. Upon the upper ends of the pipes 30 are valve casings 31, provided with valves 33 to regulate the admission of air, and with deflector plates 32 extending across the axes of the casings 31 to arrest any pulp that might be thrown upwardly in the pipes 30. The circular movement of the pulp as it is thrown upwardly is arrested by the plates 29, thus causing the pulp to fall into the launder formed outside of the liner 17 by the upper part of the liner, the outwardly extending floor 12 and the vertical wall 13.

The spitz box or separating box C is placed opposite and adjacent the agitation vessel D and is of the usual tapering form at its lower end. The side 40 of the separating box adjoining the agitation vessel is provided with an opening 20′, registering with the opening 20 in the enlarged part 13 of the agitation vessel, and a sliding valve or gate 41 is provided for regulating the opening 20—20′. The gate 41 is suspended on screw-threaded rods 42 in engagement with screw-threaded adjusting wheels 43 which rest upon supports at the upper edge of the wall of the box.

Extending upwardly and outwardly from a point below the opening 20—20′ I provide a guide plate 45 designed to give an upward direction to the pulp issuing from the opening 20—20′.

The box C is provided with an adjustable overflow gate 46. Extending upwardly from the bottom of the separating box C is a partition or baffle 48, the upper edge of the same being located about midway between the bottom of the box and the water level therein as determined by the overflow gate 46.

Pulp enters and leaves the apparatus through inlet and outlet openings 50 and 49, in the sides of the separating box, but is prevented by the baffle 48 from passing through the separating box without traversing the agitation vessel. Extending from the lower part of the separating box are two circulation pipes or ducts 60, 61, one on each side of the baffle 48. These pipes 60, 61 extend upwardly to the side of the box next the agitation vessel, where they communicate through ports in the side of the box, with the ducts 18, 19, extending outwardly from the lower part of the agitation vessel. The openings in the lower ends of the pipes 60, 61, are controlled by valves 62, 63, which have arms pivoted to said pipes as indicated at 64 and 65 and have an arcuate movement across the ends thereof. The valves 62, 63, are provided with operating rods 70, and are adjusted by hand wheels 71 screw-threaded thereon. The inlet and outlet openings 50 and 49, are regulated by valves 51, 52, which are operated by hand wheels 57, 58, screw-threaded on operating rods 55, 56. The baffle 48, is provided with an opening 72 at the lower part of the separating box, which opening is normally closed by a valve 73, when the apparatus is in operation, the valve 73 being opened only when one unit of a series is to be put out of operation without disturbing the operation of the other members or units of the series.

Water supply pipes 74, having their ends directed into the ends of the pipes 60 and 61, are provided for the purpose of flushing the apparatus in case it gets clogged through settlement of the pulp.

In operation the apparatus may be used either in single units or in series as diagrammatically illustrated in Fig. 4. In operation the apparatus is first started or primed with water, ore pulp not being admitted until after the apparatus is started with water. In this way all liability is avoided of clogging the apparatus by settlement of the ore, which might occur if pulp were admitted before a current was established through the apparatus. In starting a single unit of the apparatus, the outlet valve 49 of the separating box is closed and the inlet and circulation valves opened. As soon as the apparatus fills with water to a height sufficient to submerge the lower agitator 23, the agitator commences to agitate and force the water upward in the agitation vessel D, and to throw it through the opening at the top thereof, whence it flows through the duct 20—20′ to the separating box C. A higher effective level or hydraulic head is thus established in the separating box and the water begins to flow back to the agitation vessel D through the ducts 60, 61, thus establishing the local circulation. Thereupon the outlet 49 is opened, and pulp instead of water is admitted through the inlet 50. If several units are to be operated in series as diagrammatically illustrated in Fig. 4, the several units are preferably arranged upon an incline, the pulp entering the highest unit and discharging from the lowest. In Fig. 3 I have shown the bottom of the separating box inclining downward from the inlet to

the discharge side, and this inclination is continuous in a series of machines, the bottom 90 extending under all of the separating boxes at the same inclination and the different boxes being separated from each other by vertical walls 91. The extent of local circulation imparted to the pulp in each unit of the apparatus may be regulated through adjustment of the valves and speed of the agitators, the circulation being brought about by the fact that pulp is discharged upward from the agitation vessels into the spitz box at a more rapid rate than it is supplied to and discharge from the apparatus through the inlet 50 and outlet 49. The baffles or partitions 48 prevent the heavy and coarse material or any part of the pulp from passing directly through the separating box without entering the agitation vessel and thus insure circulation. I provide an opening 72 in the baffle or partition 48, but this opening is closed in the operation of the apparatus by a valve 73. In case however it is necessary to stop the operation of any one unit of a series for repairs or other purpose, this may be done without interrupting the operation of the other members of the series, it being necessary merely to open the valve 73 in the partition or baffle, thus permitting the pulp to flow directly through the separating box C of the disabled unit, without traversing the agitation vessel thereof.

In operation it may be found advantageous to adjust the gate 41 controlling the port 20—20′ leading to the separating box from the agitation vessel with the lower edge of the gate beneath the liquid level. In this event air cannot flow into the agitation vessel through the port 20—20′, and I have therefore provided the air pipes 30 hereinbefore described, and the air valves 33 whereby the amount of air admitted to the agitation vessel may be controlled for the purpose of governing the character of froth produced.

What I claim is:

1. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, and means for moving an ore pulp upwardly in said vessel and into said box.

2. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

3. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with valved admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, valves in said ports, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

4. In a device of the class described, an agitation vessel, a separating box adjacent said vessel and communicating therewith through two ducts adjacent the bottom thereof, a baffle extending upward from the bottom of said box between said ducts to a point above the same, admission and discharge ports communicating with said box on opposite sides of said baffle, and means for moving an ore pulp upwardly in said vessel and into said box.

5. In an apparatus of the class described, a series of separating boxes and agitation vessels, each of said separating boxes having communication adjacent its lower end with an adjoining agitation vessel, and each box having communication adjacent its lower end with the next succeeding box, a duct extending from each agitation vessel above the liquid level in the adjoining separating box and opening into said box, means for forcing an ore pulp upwardly in said agitation vessels, and means for compelling pulp entering each box to pass through the adjoining vessel before passing to the next box.

6. In a device of the class described, an agitation vessel, a separating box extending to a lower level than said vessel, an upper duct connecting said vessel and box at a point higher than the liquid level therein, and a lower duct connecting the same beneath the liquid level, and means in said vessel for agitating an ore pulp and impelling the same upward through said duct.

7. In a device of the class described, a separating box provided with an overflow, an agitating vessel of less depth than said box and opposite the upper part thereof, said vessel having an opening above said overflow and leading to said box, said vessel and box being also connected by a duct leading from the lower part of said box, and means in said vessel for agitating an ore pulp and impelling same upwardly.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms

thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough.

9. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough, said partitions having orifices and valves controlling said orifices.

10. In a device of the class described, an agitation vessel and separating box communicating with each other by a duct extending above the liquid level in said box and opening into said box substantially at the liquid level, a substantially air-tight cover over said box, said cover having air inlet openings and means for controlling the inflow of air through said openings.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:
R. H. HAWLEY,
WALTER A. SCOTT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker Deputy.

Plaintiff's Exhibit No. 34.

T. A. JANNEY

ORE CONCENTRATING APPARATUS.

APPLICATION FILED APR. 23, 1914.

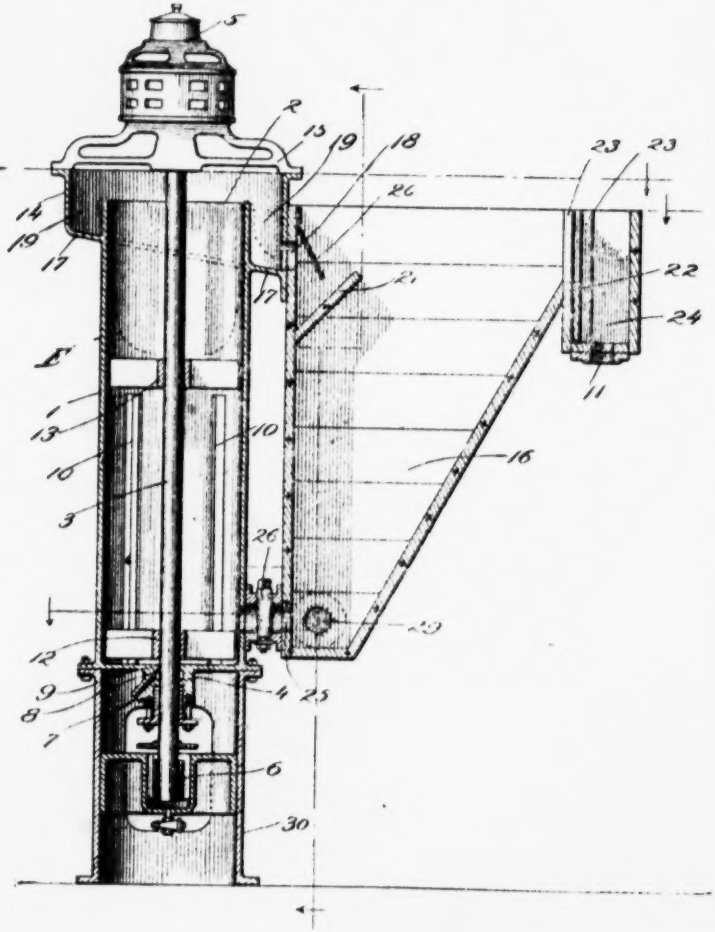
1,201,053.

Patented Oct. 10, 1916.

3 SHEETS—SHEET 1.

50006

Fig. 1.



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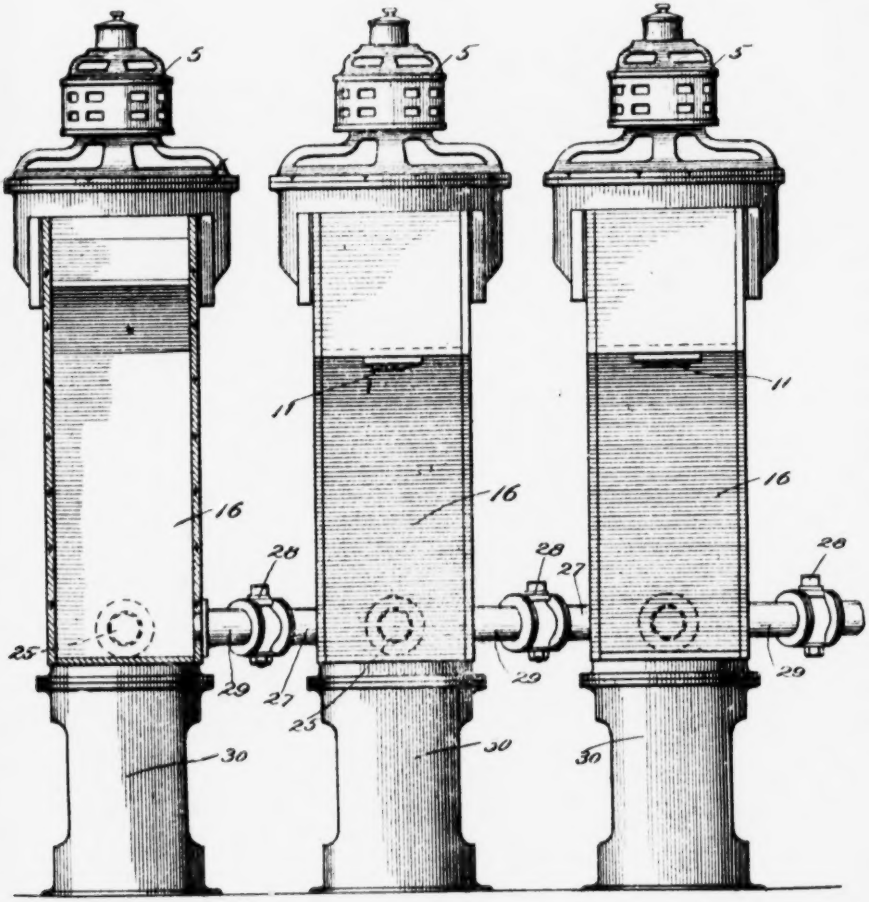
3 SHEETS—SHEET 2.

5007

Fig. 2.



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ORE CONCENTRATING APPARATUS.

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3 SHEETS—SHEET 3.

5008

Fig. 3.

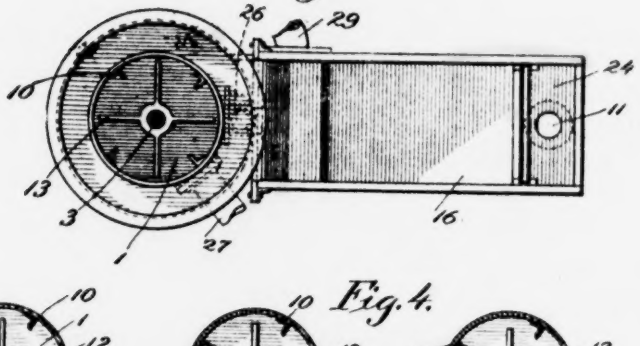
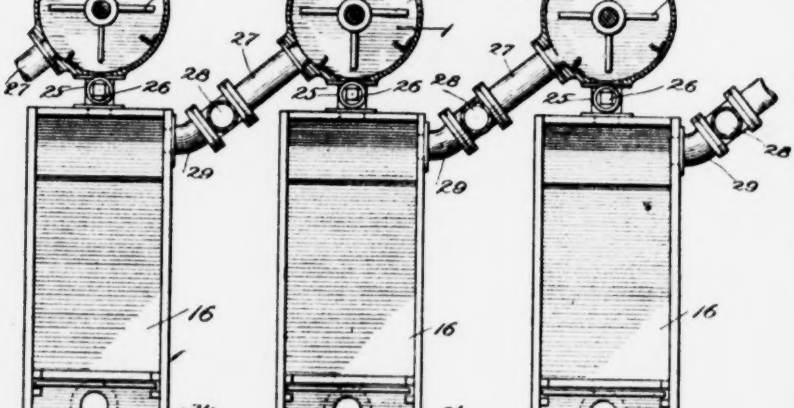


Fig. 4.



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UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

1,201,053. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed April 23, 1914. Serial No. 833,973.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus of which the following is a specification.

My invention has for its object the improvement of apparatus used in the concentration of ores by the oil flotation process, in which process the ore mixed with water in the form of a freely flowing pulp is agitated with oil and other reagents, if such are necessary or beneficial, with the result that the metalliferous part of the ore is caused to float when the pulp is removed from the zone of agitation and permitted to assume a condition of substantial quiescence. This process can be carried out in many different forms of apparatus, but the apparatus forming the subject-matter of my invention possesses several distinct and novel advantages, among which are the facts that the apparatus, embodying a series of agitating chambers or mixers and separation boxes, or spitz-boxes, may all be arranged upon the same level, the energy used for agitating the pulp serving in conjunction with gravity the purpose of moving the pulp through the series of agitation chambers and spitz-boxes. In my improved apparatus the mixture may also be subjected to successive periods of agitation and flotation in each unit of the series, this being effected by moving the mixture through as many cycles as desired in each unit before it passes to the next unit of the series. Another advantage arises from the fact that when a single agitating chamber and separating box are used for treating a single charge, the pulp may be permitted to circulate for an indefinite period of time through said chamber and box without personal attention, the floating concentrate being allowed to accumulate in the separating box from which it may be removed intermittently by mechanical means or overflow, or being removed by overflow continuously as formed, such overflow being effected by a suitably regulated supply of water or pulp. Other advantages in simplicity of structure of the apparatus, durability and simplicity of operation will appear from the following description and drawings, in which—

Figure 1 is a vertical sectional view through an agitating chamber and separating box. Fig. 2 is an elevation partly in section of several units connected in series, each unit consisting of an agitating chamber and separating box, the section being through the separating box of the first unit. Fig. 3 is a plan view of the structure shown in Fig. 1; and Fig. 4 is a fragmentary plan view of the structure shown in Fig. 2, the agitating vessels being in section upon a plane between the lower and upper agitators.

I will describe the mechanical construction of the apparatus principally with reference to Figs. 1 and 3 for the reason that those figures being in section best illustrate the interior construction. While in my description I refer to the specific form and arrangement of various parts, it will be apparent that wide variations may be made in the mechanical form of the apparatus without departing from the invention as defined in the appended claims.

The agitating chamber 1 is preferably cylindrical in form with an open upper end forming a discharge outlet 2. A rotary shaft 3 extends axially into the interior of the agitating chamber 1. In the form of the device illustrated the shaft 3 is rotated by an electric motor 5 supported upon the top of the apparatus and the lower end of the shaft 3 extends through the bottom of the vessel 1 and is provided with a bearing 6 beneath and exterior to the vessel 1, which is supported upon a suitable standard 30. Leakage from the vessel 1 is prevented by a stuffing-box 4 of any suitable form. For the purpose of protecting the packing in the stuffing-box 4 and the bearing 6 from the injurious action of any of the pulp which might leak past the stuffing-box, I provide a small opening, or duct, 7 leading through the wall of the stuffing-box above the packing therein and opening into an annular chamber 8, which communicates through passage 9 with the lower part of the vessel 1. A constant supply of clear water under sufficient pressure passes through the duct 7 into the vessel 1, thus preventing leakage of any pulp with its contained ore. The

water so supplied through the passage 7 may, under some conditions of operation, serve the additional purpose of maintaining the pulp in the apparatus at the proper level, that is, the water so supplied may be utilized to compensate for the lowering of level that would otherwise be caused by withdrawing the floating concentrate. The bearing 6 beneath the vessel 1 serves to hold the shaft 3 in proper alinement and to prevent vibration or whipping.

Projecting inwardly from the wall of the cylindrical vessel 1 are a plurality of baffles 10 which take the form of inwardly projecting ribs. These baffles extend upwardly about midway the height of the vessel 1. Upon the shaft 3, adjacent the bottom of the vessel 1, there is secured an agitator or impeller 12, which preferably takes the form of a series of radiating arms, four in number, as shown in the construction illustrated. The radial arms of the agitator 12 extend outwardly with just sufficient clearance for safety between the ends thereof and the baffles 10. A second agitator or impeller 13 is secured to the shaft 3 just above the upper ends of the baffles 10, the radial arms of the upper impeller preferably being longer than those of the lower impeller and having just sufficient clearance between their ends and the wall of the vessel 1 to afford safety of operation.

Rotation of the agitators 12 and 13, in conjunction with the baffles 10, serves to impart a violent agitation to the pulp treated in the apparatus. The lower agitator in conjunction with the baffles imparts a violent agitation to the pulp, thus thoroughly intermingling the ingredients thereof, and also serves through centrifugal force to impart a tendency to the pulp to rise upon the walls of the vessel. The upper agitator 13 lying near the surface of the pulp imparts further rotary movement to the same and centrifugal force causes the pulp to rise upon the walls of the vessel and overflow the upper edge of the same as diagrammatically indicated by the dotted line E in Fig. 1. Of course the precise configuration of the upper surface of the pulp will vary according to conditions such as the speed of agitation and rate of supply of pulp to the apparatus. In order to avoid the possibility of any of the pulp being ejected from the apparatus, I preferably inclose the upper end of the agitating chamber 1 with a hood 14 which surrounds the upper end of the agitating chamber and extends a short distance above the same. The upper end of the hood 14 may be closed by a cover 15. Adjoining the agitating chamber 1 is a separating box 16, the same preferably taking the form of a spitzbox, or box tapering to substantially a point at its lower end.

The hood 14 is closed by a lower wall 17 situated beneath the upper edge or discharge opening 2 of the chamber 1, said wall 17 closing the bottom of the annular space between the agitating chamber and hood and forming a launder to receive the pulp. Just above the wall 17 is a discharge duct 18 leading from the annular space 19 to the upper part of the separating box 16. In order to keep the material in the separating box 16 substantially quiet, I provide a deflector or baffle 20 extending downwardly from the wall of the hood 14 across the opening 18 and spaced sufficiently from the opening 18 to permit free flow of the pulp. I may also provide a second deflector or baffle 21 projecting upwardly across the opening 18 beyond the deflector 20. These deflectors serve to arrest the current of pulp flowing into the separating box and to convey the pulp into the separating box without causing any material disturbance of the pulp therein, thus producing a condition conducive to the formation of the floating concentrate.

At one or more edges the separating box 16 is provided with an overflow lip at substantially the same level as the bottom of the port 18. Said lip is formed by the upper edge of a wall 22, which may be adjustable through a small range, taking the form of a vertically movable gate operated by any suitable means between guides 23. The rate of flow of pulp through the apparatus may be so regulated that the floating material flows over the upper edge of the gate 22 into the launder 24 from which the same may be collected through the discharge opening 11 as a finished concentrate, or for further treatment as the case may be. By reason of the duct 18 and discharge lip of the gate 22 being upon substantially the same level the agitated pulp from the agitating vessel is deposited upon the surface of the pulp in the separator box. I find this to be a distinct advantage over apparatus in which the agitated pulp is discharged into the separator box a considerable distance beneath the surface of the pulp in the separator box.

The lower part of the separating box 16 is connected with the lower part of the agitation vessel 1 by means of a passage 25. The passage 25 opens into the vessel 1 opposite or above the lower agitator 12, the effect of this location of the opening of the passage 25 into the vessel 1 being that the pulp enters the vessel 1 from the separating box 16 against the outward centrifugal force imparted to the material in the vessel 1 by the agitator 12. That is, the flow of pulp from the separating box 16 into the vessel 1 is retarded, but not prevented, by the agitator 12. For the purpose of regulating the flow of pulp from the lower part of the separating box into the vessel 1 the passage 25 is provided with a regulating valve 26, which may be of any suitable form, such as a plug

valve. Pulp is supplied to the apparatus through the pipes or ports 27. These ports 27 are provided with suitable regulating valves 28. After treatment in the apparatus, or one unit thereof, the pulp is withdrawn through the ports 29, which lead from the lower parts of the spitz-boxes.

When the apparatus is used in series, as illustrated in Figs. 2 and 4, the outlet ports 29 from the separating or spitz-boxes 16, communicate with the inlet ports 27, which communicate with the next adjacent agitating vessel. When the apparatus is used as a single unit, either for experimental or practical operations, the inlet port 27 of the agitating vessel 1 is closed after the apparatus is charged with the proper amount of pulp and other ingredients, and the outlet port 29 leading from the spitz-box 16 is also closed until it is desired to discharge the residues or tailings. When operated as a single unit the port 29 is first closed and a suitable amount of pulp with the other necessary ingredients is charged into the apparatus through the port 27, or, if convenient, simply through the open top of the separating box, or in any other convenient manner.

In operating upon a single charge, as above stated, it will be understood that both of the ports 27 and 29 are closed and the port 25 is opened to a suitable extent through manipulation of the valve 26. The charge of pulp supplied to the apparatus is insufficient to fill the same and preferably the level of the pulp before agitation is started is considerably below the upper edge of the chamber 1. The rotation of the agitators 12 and 13 imparts a violent agitation to the mixture of ore, pulp and oil, thus disseminating the oil and causing efficient contact thereof with the metalliferous mineral particles and at the same time impels the pulp mixture upward through the agitating chamber 1 and discharges the same over the top edge, 2, thereof, as hereinbefore explained. The pulp so forced upwardly out of the agitating chamber falls in the annular space 19 between the upper end of the agitating chamber and the surrounding hood and by gravity flows through the duct 18 into the separating box 16, the pulp at the same time flowing from the bottom of the separating box 16 into the lower part of the agitating chamber 1 by reason of the higher head of water established in the separating box 16 due to the discharge of pulp therein through the duct 18. A continuous current of pulp mixture upward through the agitating chamber 1 and downward through the separating box 16 is thereby caused.

The operation as described is to cause the oiled metalliferous part of the ore to float upon the surface of the pulp in the separating box, the surface of which is substantially quiet. If desired the level of the pulp in the separating box 16 may be so maintained that the floating concentrate as formed will float over the upper edge of the gate 22 into the launder 24. Such regulation of the level of the pulp may be effected in various ways, as by the inflow of water through the passage 7 at the lower end of the agitating vessel. If desired the surface of the pulp in the separating box 16 may be maintained at a point below the upper edge of the gate 24 and the froth as formed may be removed by mechanical means such as skimming.

In the operation of the apparatus as a single unit, as above described, the pulp is thoroughly agitated, together with the materials added thereto, and is impelled upward through the agitating vessel 1, whence it flows through the port 18 into the separating box 16, downward through the separating box and back to the agitating vessel 1 through the port 25. The pulp thus moves through a continuous cycle comprising alternate periods of agitation and quiescence. During the period of quiescence the concentrate which has been sufficiently treated floats upon the surface of the pulp in the separating box 16, while the remainder of the pulp continues to circulate through the agitating vessel and spitz-box. As the pulp so circulates floating concentrate gradually separates therefrom upon the surface of the pulp in the separating box until the material treated is practically exhausted of its valuable content. I have found that in the operation of the apparatus the continuous circulation of the pulp through the separating box and agitating vessel takes place without material interference with the flotation of the concentrate and that the amount of floating concentrate upon the surface of the pulp in the spitz-box gradually increases. A considerable amount of concentrate may be allowed to so accumulate upon the surface of the pulp in the spitz-box before it is necessary to withdraw the same. In operation, however, I find it preferable to remove the float from the surface of the pulp in the spitz-box at intervals or continuously and before too great a volume of float has been built up. As above indicated the removal of the float may be either intermittent and effected by overflow or mechanical means, or the removal of the float may be effected by maintaining a suitable supply of water through the port 7, clear water being supplied when it is desired to treat a definite amount of ore.

A single unit of the apparatus, such as illustrated in Fig. 1, or several units connected in series, as shown in Fig. 2, may be used for the treatment of a continuous flow of pulp through the apparatus. I will first refer to the use of a single unit of the appa-

ratus in operating continuously upon pulp flowing therethrough. When a single unit of the apparatus is used for continuous treatment of ore pulp, as distinguished from a treatment of a single charge, the pulp is supplied to the mixing vessel 1 through the port 27, which need not be located precisely as shown in the drawings, but is preferably located somewhere adjacent the bottom of the mixing vessel. The port 25 is left open, adjustment of the duct through the port, if necessary, being made by means of the valve 26. The pulp carrying with it oil and such other ingredients as necessary for the flotation of pulp flowing in through the port 27 is subjected to violent agitation and to an upward force due to the rotation of the agitator 12 and further agitation and upward impulse is given to the pulp by the rotation of the upper agitator 13. The upward impulse so imparted to the pulp carries the same over the upper edge of the agitation vessel 1 and into the launder 19 and through the port 18 to the separating box 16 as above described. The surface of the pulp in the separating box 16 being substantially quiet the concentrate floats thereon as soon as the material has received sufficient treatment to produce that effect. As the rate of discharge through the port 29 is substantially constant, and as the agitator-impeller moves the pulp from the agitation vessel to the separator box at a more rapid rate, the excess pulp so moved to the separator box will return to the agitation vessel through the port 25, and will continue to move through the local circuit or cycle comprising the agitation vessel, separator box and connecting ports until finally discharged through port 29. By suitable adjustment of the valves and speed of the agitator-impeller the amount of pulp which is moved through this local circuit and the number of cycles of movement imparted to it may be regulated. For instance, if the port 29 be considerably restricted and the port 25 be opened to a relatively large extent, a portion of the pulp will circulate through the circuit formed by the agitation vessel, the port 18, the settling box 16, and the passage 25, a considerable number of times before being discharged through the port 29, the amount of such circulation imparted to the pulp depending, as above stated, upon the degree to which the ports 29 and 25 are opened and will also be influenced by the speed of the agitator. During the operation of the apparatus as described the concentrate will gather as a float upon the surface of the pulp in the settling box 16 and may be removed continuously by regulating the feed through the port 27 in such manner that the floating material will pass over the upper edge of the gate 22 into the concentrate launder 24. Or the float may be removed intermittently or continuously by mechanical means, such as a skimmer, or by successive intermittent adjustments of the pulp level.

In the use of mechanism, such as heretofore employed in the flotation process, the pulp passes through each agitating vessel but once and successive treatments of the pulp are obtained only by increasing the number of agitating vessels. In my improved apparatus if the working capacity of the apparatus is 500 gallons and 100 gallons per minute are constantly fed through the inlet port 27 and a corresponding amount per minute constantly discharged through the waste port 29, in conjunction with that taken off as concentrate in the concentrate launder 24, there will constantly be in circulation in the apparatus 500 gallons of pulp. Owing to the fact that the agitators impel the pulp at a rate much greater than 100 gallons per minute, a portion of the pulp will circulate through the agitating vessel 1 and separating box 16 many times before it is discharged through the port 29. In other words, the agitators impel the liquid from the agitating vessel into the spitz-box at a more rapid rate than the pulp can be discharged through the waste port 29, and the result is that the material not discharged through the waste port 29 again enters the agitation vessel 1, through the port 25 to again pass through the same circuit until finally withdrawn through the port 29 as waste or into the launder 24 as concentrate. While the flow of pulp from the separating box 16 through the port 25 into the agitation vessel 1 is somewhat resisted by the outward centrifugal force set up by the lower agitator 12, the head of pulp in the separating box 16 when the pulp has risen sufficiently therein will overcome such resistance and cause the flow of pulp back into the agitation vessel in the course of its circulation through the circuit above described.

When a plurality of units, such as illustrated in Fig. 1, are used in series the several units are connected as shown in Fig. 2, the outlet port 29 of the separating box of the first unit of the series being connected to the inlet port 27 of the agitation vessel of the next unit of the series, the valve 28 serving to control the flow of pulp from one unit to the next. When so used in series the pulp is treated in each unit of the apparatus as heretofore described in connection with the single unit shown in Fig. 1, the pulp not only passing through the entire series of units, but being subjected to local circulation in each unit as above described in connection with the apparatus shown in Fig. 1. The extent of local circulation to which the pulp is subjected in each unit of the series is determined as above described. In my

improved apparatus when so used in series the pulp instead of being conveyed directly through the several units of the series, as in apparatus heretofore used, is caused to circulate many times through each unit before passing to the next unit of the series, and during such repeated local circulation is subjected to repeated periods of agitation and quiescence for the formation of floating concentrate.

It will be apparent that agitating mechanism different from that herein illustrated and described may be used for agitating the pulp and causing the circulation described above, and that many of the details of construction may be altered without departing from the principle of my invention.

I claim:

1. In a concentrating apparatus, an agitation vessel and separating box communicating with each other through upper and lower ports, and agitating and impelling means in said vessel for agitating an ore pulp therein and adapted to move all of said pulp from said vessel into said box and to move the pulp in a circuit through one of said ports to said box and back through the other port to said vessel, said box having an overflow lip below the level of said upper port.

2. In a device of the class described, an agitation vessel and separating box having communication with each other through ports at the upper and lower parts thereof, and means for imparting agitation to an ore pulp contained in said vessel and for moving all of said pulp from said vessel through said upper port into said box and for causing pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

3. In a device of the class described, an agitation vessel, means therein for agitating and impelling upwardly an ore pulp, a separating box, an upper duct connecting said vessel and box, said agitating and impelling means being adapted to move all of said pulp from said vessel to said box through said upper duct, and a second duct for conducting pulp back to said vessel from said box, said box having an overflow lip below the level of said upper port.

4. In a concentrating apparatus, a mixing vessel and a separator box having communication ports at points adjacent the top and bottom thereof, and a rotary agitator in said vessel adapted by centrifugal force to elevate all of the ore pulp contained therein and thereby to cause said pulp to flow into said separator box through the upper port, said box having an overflow lip below the level of said upper port.

5. In a concentrating apparatus, an agitation vessel and separator box communicating with each other through two ports, means for feeding pulp to said apparatus and for discharging the same therefrom, and means for agitating said pulp and for moving all of said pulp from said agitation vessel to said separator box at a more rapid rate than the pulp is fed to and discharged from said apparatus, thereby setting up a local circulation of pulp through said vessel, box and connecting ports.

6. In a concentrating apparatus, a mixing vessel and a separator box having communication ports therebetween at points adjacent the top and bottom thereof, said vessel having an ore pulp feed port and said box a tailings discharge port, and a rotary agitator in said vessel adapted to elevate all of the ore pulp supplied thereto and to discharge the same into said box at a more rapid rate than said pulp can be discharged through said discharge port, thereby causing part of said pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

7. In a flotation concentrating apparatus, an agitation vessel having an inlet port for ore pulp, a rotary agitator in said vessel, and a separator box having a discharge lip over which floating concentrate may flow, said vessel and box being connected by a duct above said discharge lip at the upper part of said vessel and opening into said box at substantially the same level as said discharge lip, said agitator being adapted to raise all of the ore pulp supplied to said vessel and to discharge the same through said duct upon the surface of the ore pulp in said box.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, the vessel and box of each unit having communication with each other through ports at the upper and lower parts thereof and the box of each unit having communication with the vessel of the next succeeding unit, the first agitation vessel of the series having an inlet port for ore pulp, and means for imparting agitation to the ore pulp in said vessels and for moving all of the ore pulp supplied to each vessel to the communicating box and causing a circulation of pulp through the vessel and box of each unit of the series.

9. In a device of the class described, an agitating vessel having an open upper end, a rotary agitator therein, a launder surrounding the upper end of said vessel to receive ore pulp discharged therefrom, a separator box communicating with said launder, and having an overflow lip below the upper end of said vessel, a duct connecting said box and vessel at a point below said launder, said agitator being adapted to elevate all of the pulp supplied to said vessel and to discharge the same into said box.

10. In a device of the class described, an agitation vessel, having an opening adjacent

its upper end, a separating box having an overflow lip below the level of said opening, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said second agitator being adapted to operate adjacent the surface of an ore pulp contained in said vessel, said rotary agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box.

11. In a concentrating apparatus, an agitation vessel and separating box having communication with each other at the upper and lower parts thereof, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box thereby causing the pulp to move in a circuit through said vessel and box and to be subjected to alternate periods of agitation in said vessel and substantial quiescence in said box, said separating box having an overflow lip below the level of the upper communication between said vessel and box.

12. In a device of the class described, an agitation vessel having an upper discharge opening, a separating box having an overflow lip below said discharge opening, means for admitting ore pulp to said vessel, means for impelling all of said ore pulp upwardly through said discharge opening to said box, said box being connected with said vessel by a duct leading from the lower part of said box to said vessel.

13. In a device for treating ore pulp, an agitation vessel and separating box, means for admitting ore pulp to said vessel, a wall between said vessel and box, means for maintaining the level of the pulp in said box below the upper edge of said wall, means for impelling all of the pulp supplied to said vessel upwardly and over said wall into said box, and a duct leading from the lower part of said box to said vessel.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:
WALTER A. SCOTT,
CHARLES E. BURNAP.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Defendants' Exhibits, Nos. 35 to 44, inclusive.)

Defendant's Exhibit No. 35.

UTAH COPPER COMPANY
MAGNA PLANT
Flotation Retreatment Plant Results—Treating Mineral Classifier Overflow and 4th and 5th Spigot
September 1, 1914, to December 24, 1916—Inclusive

Month	Tonnage	HEADING % Cu.	HEADING % Fe.	TAILING % SiO2	TAILING % Cu.	TAILING % Fe.	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si O2	Indicated Extraction	Ratio of Concentration	Per Ton Sold	Lbs. Oil Per Day	Lbs. Oil Per Ton
1914														
September	9258	11.55	6.43	69.24	.57	.97	34.32	16.86	15.27	96.67	2.97	41.67	941	305
October	10385	10.38	6.31	70.94	.46	1.21	36.52	19.11	11.20	97.21	3.61	45.46	852	2.62
November	13104	9.74	7.00	71.26	.42	1.21	34.45	20.57	12.19	96.87	3.55	50.00	922	2.11
December	11776	10.11	6.26	71.56	.96	1.23	35.39	19.60	13.93	93.03	3.76	40.76	847	2.23
1915														
January	10171	9.43	6.80	70.52	.33	.73	32.87	22.89	12.64	97.51	3.62	42.78	1303	3.97
February	12686	8.13	5.97	74.18	.37		32.12	22.70	14.93	96.38	4.14	44.20	761	1.81
March	16430	8.16	6.08	74.52	.93		29.70	21.58	19.08	91.66	4.09	42.89	641	1.23
April	18350	9.19	6.73	71.42	.48		29.29	20.98	18.36	94.41	3.33	42.13	1133	1.85
May	20229	9.79	6.90	70.69	.29	.69	31.93	21.14	14.81	97.97	3.33	40.42	1434	2.20
June	19036	9.50	6.85	70.58	.42	.75	30.14	20.44	17.12	96.84	3.30	32.10	2607	3.84
July	17613	8.71	6.44	72.69	.43	.64	29.92	20.28	17.24	96.51	3.58	35.58	2629	4.63
August	17778	9.05	6.70	71.76	.29	.60	29.78	20.58	17.00	97.73	3.38	34.72	2185	3.81
September	19314	8.22	6.48	73.09	.40	.58	29.62	22.18	15.06	96.63	3.71	39.40	2465	3.86
October	20792	8.76	6.78	72.48	.35	.64	30.08	21.66	15.30	97.27	3.56	40.86	2530	3.77
November	21211	9.36	7.62	69.36	.32	.58	29.00	22.54	14.70	97.64	3.18	42.08	3058	4.32
December	21216	9.22	7.12	70.56	.22	.54	29.73	21.84	15.22	98.34	3.31	40.56	3225	4.71
1916														
January	18527	8.28	6.36	73.68	.18	.51	31.12	21.61	15.28	98.44	3.86	37.18	3055	5.11
February	19000	7.95	5.42	76.03	.24	.50	32.61	19.80	14.95	97.60	4.28	34.96	3257	4.97
March	20003	7.64	6.51	73.88	.20	.50	28.11	21.16	16.16	98.07	3.76	29.20	3354	5.20
April	21425	7.90	6.51	73.37	.36	.48	27.60	21.06	18.30	96.68	3.62	28.82	3758	5.37
May	24142	7.25	6.06	75.23	.28	.50	27.55	20.74	19.4-	97.09	3.91	31.12	3650	4.69
June	28510	7.62	5.78	75.56	.34	.52	30.10	20.84	16.14	96.62	4.12	30.66	3731	3.93
July	29910	7.62	6.00	75.10	.26	.51	30.48	21.53	15.74	97.42	3.96	29.20	3759	3.90
August	30333	7.68	6.08	75.19	.26	.54	29.87	21.19	16.01	97.52	3.98	32.08	3784	3.87
September	30266	7.80	5.90	75.02	.25	.47	29.88	20.62	17.20	97.57	3.93	33.34	3985	3.95
October	32494	7.67	6.07	74.92	.18	.58	30.75	21.18	14.86	98.31	4.08	33.20	3932	3.75
November	30375	7.35	5.70	76.08	.17	.60	29.78	20.40	17.00	98.24	4.13	33.82	3804	3.76
December (24 days)	24429	6.92	5.65	76.70	.12	.54	29.09	20.94	17.37	98.09	4.26	33.45	3903	3.83
AVERAGE		8.350	6.317	73.510	.290	.614	30.294	21.013	16.116	97.451	3.723	36.001	3790	3.790
TOTAL	568163													
AVG. PER DAY	671.6													

R. A. CONRADS,
Metallurgical Engineer.

Magna, Utah,
April 7, 1917.

Filed May 18, 1917 GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 36.

UTAH COPPER COMPANY—MAGNA PLANT
METALLURGICAL DEPARTMENT

Composite Flotation Retreatment Plant Results for Period December 25, 1916 and April 7, 1917, Inclusive

DATE	HEADING				TAILING			CONCENTRATE				Per Cent Indicated Extraction	Ratio of Concentr'n	Pounds New Oil Added	Lbs. Oil in Circulation	Excess Lbs. Circulating Oil	Total Lbs. Oil—New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Lbs. Excess Circulating Oil Per Ton	Total Lbs. Oil Per Ton New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
	Dry Tons	% Cu.	% Fe.	% SiO2	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% SiO2														
December	4011	5.616	3.529	83.580	3284	.126	.327	727	33.218	16.433	20.713	98.223	6.170	63883			63883	15.93			15.93		38.160	8462	2.11
January	28722	6.515	4.958	78.766	22343	.106	.372	6379	29.414	19.664	19.361	98.727	4.573	528760	103358	103358	632118	18.41	7.02	3.60	22.01	2555	32.736	71282	2.48
February	26206	6.925	6.028	75.808	20091	.121		6115	29.337	22.637	14.143	98.660	4.294	296607	311612	311612	608219	11.32	11.89	11.89	23.21	7372	31.021	94899	3.62
March	31266	6.561	5.871	76.678	23356			22361	27.369	21.691	17.143	97.887	4.261	465352	241859	179564	644916	14.88	7.74	5.74	20.62	3599	29.438	111975	3.58
April	7589	6.351	6.092	76.910	5905	.181		7856	24.731	21.618	20.625	95.230	4.089	112401	20818	9603	122004	14.81	2.74	1.27	16.08	599	32.165	26023	3.43
Total	97794				75733	.401		1438						1467003	677647	604137	2071140					14125		312641	
Average	940	6.590	5.566	77.359	725	.157	.366	216	28.458	21.196	17.359	98.161	4.399	14106	6516	5809	19915	15.001	6.929	6.178	21.179	136	31.276	3006	3.197

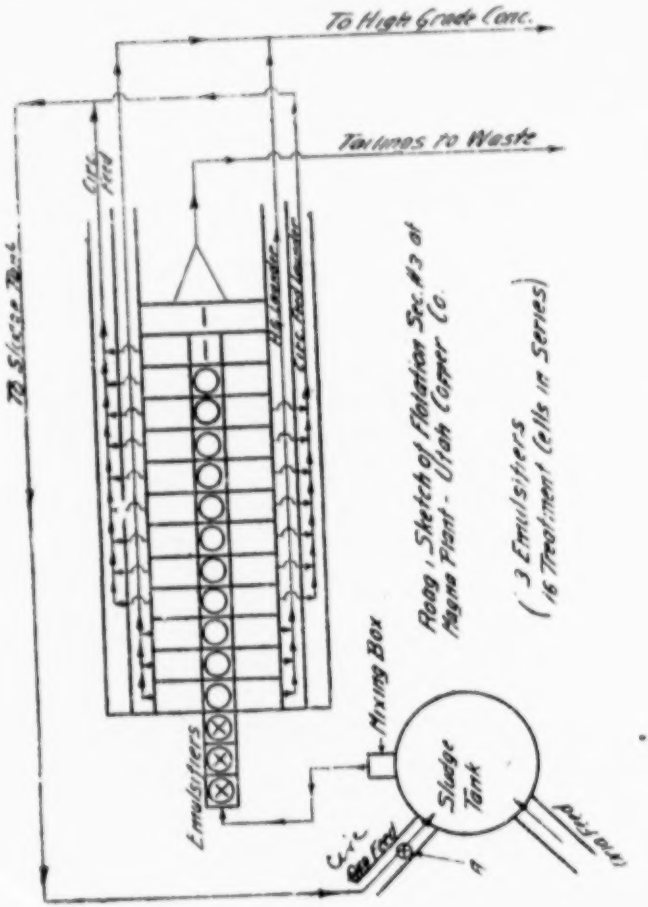
R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Butte & Superior Mining Company.

9019

Defendant's Exhibit No. 37.



Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy

Defendant's Exhibit No. 38.

UTAH COPPER COMPANY—MAGNA PLANT

METALLURGICAL DEPARTMENT

Statement Showing Loss in Pounds of Copper and Consequent Monetary Losses Due to Abnormal Tailing Caused by Variation in Amounts of Oil Used per Ton of Ore Treated. —Comparisons Being Made Between a Normal Period from December 25, 1916, to March 24, 1917—And Abnormal Days from March 25 to April 2, 1917. —Copper Figured at Various Prices.

DATE	Avg. Lbs. Oil Used Per Ton Ore Treated	Avg. Dry Tons Treated Per Day	Average % Cu. in Tailing	Average % Cu. in Concent.	Average % Fe. in Concent.	Average % SiO_2 in Concent.	Ratio of Concentration	Average Tons Tailing Per Day	Average % Cu. in Tailing	Loss Lbs. Cu. Per Ton	Loss Per Ton @ 15c Cu.	Loss Per Ton @ 20c Cu.	Loss Per Ton @ 25c Cu.	Loss Per Ton @ 30c Cu.	Abnormal Loss Lbs. Cu. Per Ton Tailing	Abnormal Loss Per Ton @ 15c Cu.	Abnormal Loss Per Day @ 15c Cu.	Abnormal Loss Per Ton @ 20c Cu.	Abnormal Loss Per Day @ 20c Cu.	Abnormal Loss Per Ton @ 25c Cu.	Abnormal Loss Per Day @ 25c Cu.	Abnormal Loss Per Ton @ 30c Cu.	Abnormal Loss Per Day @ 30c Cu.
NORMAL																							
12/25/16 to 3/24/17*	22.18	926	.120	29.09	21.04	16.99	4.44	715	.120	2.40	.360	.480	.600	.720									
March 25 *A	16.17	1075	.241	27.29	23.27	13.27	4.37	829	.241	4.82	.723	.964	1.205	1.446	2.42	.363	300.93	.484	401.24	.605	501.54	.726	601.85
March 26 *A	15.84	1083	.278	28.45	22.00	14.63	4.34	833	.278	5.56	.834	1.112	1.390	1.668	3.16	.474	394.84	.632	526.46	.790	658.07	.948	789.68
March 27	16.33	1021	.249	24.65	22.86	16.90	4.18	777	.249	4.98	.747	.996	1.245	1.494	2.58	.387	300.70	.516	400.93	.645	501.16	.774	601.40
March 28	16.41	1013	.300	23.12	24.01	16.80	3.84	749	.300	6.00	.900	1.200	1.500	1.800	3.60	.540	404.46	.720	539.28	.900	674.10	1.080	808.92
March 29	NO TESTS MADE																						
March 30	10.63	750	.589	24.39	20.10	25.40	4.67	590	.589	11.78	1.767	2.356	2.945	3.534	9.38	1.407	830.13	1.876	1106.84	2.345	1383.55	2.814	1660.26
March 31 *B	10.33	991	.486	24.75	23.51	18.17	4.36	764	.486	9.72	1.458	1.944	2.430	2.916	7.32	1.098	838.87	1.464	1118.50	1.830	1398.12	2.196	1677.74
April 1	5.16	1098	.560	21.78	21.98	22.63	3.76	806	.560	11.20	1.680	2.240	2.800	3.360	8.80	1.320	1063.92	1.760	1418.56	2.200	1773.20	2.640	2127.84
April 2 *C	4.16	1086	1.277	27.09	19.58	23.32	4.40	839	1.277	25.54	3.831	5.108	6.385	7.662	23.14	3.471	2912.17	4.628	3882.89	5.785	4853.62	6.942	5824.34

* Dec. 25, 1916, to Jan. 16, 1917, inclusive, no oil credited from circulation. Jan. 17th to March 3rd, inclusive, all circulated oil credited as new oil.
March 4th to 24th, inclusive, circulated oil in excess of 20 lbs. per ton dry pulp in circulation, credited as new oil.

*A Inclusive of the circulating oil in excess of 15 lbs. per ton of dry pulp in circulation.

*B Inclusive of the circulating oil in excess of 10 lbs. per ton of dry pulp in circulation.

*C Inclusive of the circulating oil in excess of 5 lbs. per ton of dry pulp in circulation.

Magna Utah.
April 16, 1917.

led May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 39.

UTAH COPPER COMPANY—MAGNA PLANT
METALLURGICAL DEPARTMENT

Composite Flotation Retreatment Plant Results—December 25th to 31, 1916, Inclusive

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % SiO2	TAILING Dry Tons	TAILING % Cu.	TAILING % Fe.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % SiO2	Ratio of Concent'n	Per Cent Indicated Extraction	OIL ORIGINAL FEED Lbs. Oil Entering Head of Machine	OIL ORIGINAL FEED Lbs. Oil per Ton	Circulating Feed % Solids	Oil Combination	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	REAGENTS Total Lbs.	REAGENTS Pounds Per Ton
12/25	340	4.77	3.75	83.47	284	.110	.33	56	28.60	19.05	20.80	6.11	98.09	5,242	15.42	26.83	95% J; 5% Yar. P. ‡	3-5	13-11	759	2.23
12/26	92	4.37	2.92	88.00	82	.085	.37	10	39.53	12.72	17.00	9.20	98.26	1,451	15.77	No Sample	"	4	12	392	4.26
12/27	572	5.59	2.55	85.00	488	.087	.37	84	37.34	13.39	22.80	6.77	98.70	6,551	11.45	33.05	"	4	12	1135	1.98
12/28	715	5.95	2.97	84.20	598	.193	.29	117	35.55	14.60	22.13	6.14	97.62	9,361	13.09	34.33	"	4-6	12-10	1230	1.72
12/29	794	6.56	3.90	81.53	644	.264	.30	150	33.58	17.03	19.33	5.29	96.71	11,051	13.92	38.42	"	4-6	12-10	1686	2.12
12/30	746	6.34	3.93	81.87	593	.074	.33	153	30.64	17.67	21.13	4.88	99.07	14,642	19.63	39.44	"	4-6	12-10	1657	2.22
12/31	752	5.73	4.68	81.00	595	.067	.30	157	27.28	20.57	21.80	4.80	99.10	15,585	20.72	38.88	"	5	11	1603	2.13
Total	4011				3284			727						63,833						8462	
Average	573	5.616	3.529	83.58	469	.126	.327	104	33.218	16.433	20.713	6.170	98.223	9,126	15.93	35.16				1209	2.11

Magna, Utah,
February 3, 1917.

‡ Oils Initialed:
J—Jones.
Y—Yaryan Pine.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 40.

UTAH COPPER COMPANY—MAGNA PLANT

METALLURGICAL DEPARTMENT

Composite Flotation Retreatment Plant Results—Month of January, 1917

DATE	HEADING				TAILING				CONCENTRATE				Ratio of Concentration	Per Cent Indicated Extraction	OIL										REAGENT	
																		ORIGINAL FEED			CIRCULATING FEED					
	Dry Tons	% Cu	% Fe.	% SiO2	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% SiO2				Pounds New Oil Added	Lbs. Oil in Circulation	Total Oil Entering Head of Machine	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil Per Ton in Circulation	Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulation	Total Lbs.	Pounds Per Ton
1	739	5.97	4.13	81.33	583	.084	.32	156	27.98	18.87	22.00	4.74	98.92	15724		15724	21.28		21.28			38.36	95% J; 5% Y. P. ‡‡	5-6	11-10	1742	2.36
2	811	6.50	3.57	80.27	653	.094	.30	158	33.04	16.17	22.33	5.14	98.84	17643		17643	21.75		21.75			37.19	"	5	11	1714	2.11
3	839	6.08	3.80	82.67	678	.065	.33	161	31.35	17.67	20.80	5.20	99.16	17503		17503	20.86		20.86			37.80	"	4-5	12-11	1430	1.70
4	863	6.87	3.40	82.13	705	.092	.32	158	37.20	15.27	19.13	5.47	98.90	18064		18064	20.93		20.93			39.50	"	5	11	1882	2.18
5	861	6.37	3.22	83.46	703	.148	.31	158	34.01	15.05	30.21	5.44	98.10	18484		18484	21.47		21.47			40.02	"	5-6	11-10	1574	1.83
6	790	6.37	2.97	81.93	644	.130	.24	146	33.97	14.58	22.03	5.42	98.33	19809		19809	25.07		25.07			38.50	97% J; 3% Y P.	4-6	12-10	1575	1.99
7	896	6.27	3.23	83.20	726	.093	.28	170	32.67	15.13	22.60	5.27	98.82	18691		18691	20.86		20.86			40.24	97.5% J; 2.5% Y. P.	5-6	11-10	2106	2.35
8	884	5.69	4.43	82.00	703	.112	.31	181	27.41	18.93	23.30	4.89	98.45	18999		18999	21.49		21.49			39.31	97% J; 3% Y. P.; 98% J; 2% Y. P.	5-6	11-10	1743	1.97
9	860	6.21	4.53	80.60	676	.067	.32	184	28.83	17.30	24.47	4.68	99.16	19043		19043	22.14		22.14			39.81	"	5-6	11-10	1992	2.32
10	838	6.75	4.30	80.00	669	.110	.52	169	33.02	19.70	19.07	4.96	98.69	18855		18855	22.50		22.50			36.31	98% J; 2% Y. P.	5-6	11-10	1715	2.05
11	911	6.60	5.48	77.80	703	.107	.32	208	28.57	21.78	18.00	4.38	98.78	18949		18949	20.80		20.80			39.92	"	5-6	11-10	1836	3.02
12	906	6.80	5.95	77.60	683	.097	.48	223	27.35	20.97	21.20	4.06	98.92	19417		19417	21.43		21.43			37.80	"	4-6	12-10	1760	1.94
13	880	6.43	5.38	78.33	677	.144	.38	203	27.37	20.74	17.53	4.33	98.23	19276		19276	21.90		21.90			38.11	"	3-6	13-10	1855	2.11
14	1029	6.45	6.07	76.86	783	.138	.36	246	26.49	22.71	15.55	4.17	98.35	23205		23205	22.55		22.55			32.20	"	2-3-6	14-13-10	2722	2.64
15	940	7.44	4.88	77.70	717	.096	.29	223	31.15	18.58	18.02	4.23	99.05	22356		22356	23.78		23.78			29.42	98% J; 2% Y. P.; 83% S. F.; 15% A. C.; 2% Y. P.	2-5	14-11	2907	3.09
16	949	6.70	4.86	78.04	715	.055	.35	234	27.10	17.37	25.35	4.07	99.39	20490		20490	21.59		21.59			26.80	83% S. F.; 15% A. C.; 2% Y. P.	2-3	14-13	1818	1.92
17	922	6.72	4.49	78.73	705	.068	.37	217	28.62	16.76	24.95	4.26	99.22	16746	4259	21005	18.16	4.62	22.78	125	34.07	25.82	"	2	14	1632	1.77
18	948	6.86	4.76	77.74	715	.067	.38	233	27.65	17.27	23.85	4.06	99.26	17336	4970	22306	18.29	5.24	23.53	208	23.89	25.52	"	2-3-4	14-13-12	3106	3.28
19	964	6.75	4.62	79.97	746	.060	.28	218	29.57	18.07	21.75	4.41	99.30	15746	6010	21756	16.33	6.23	22.56	164	36.65	24.26	83% S. F.; 15% A. C.; 2% Y. P.; 100% S. F.	2-3-4	14-13-12	2287	2.37
20	997	6.98	4.49	78.94	805	.124	.32	192	35.75	18.84	14.47	5.20	98.55	15308	5492	20800	15.35	5.51	20.86	106	51.81	28.11	100% S. F.—82.35% S. F.; 17.65% J.	3-4	13-12	2517	2.52
21	994	6.20	4.76	79.90	787	.141	.41	207	29.20	21.60	15.17	4.80	98.17	15560	5967	21527	15.65	6.00	21.65	173	34.49	32.52	82.35% S. F.; 17.65% J; 89% S. F.; 11% J.	3-4-5-	13-12-11	2044	2.06
22	1023	7.15	4.99	78.00	807	.144	.35	216	33.25	20.12	13.57	4.72	98.39	14204	7244	21448	13.88	7.08	20.96	165	43.90	29.58	89% S. F.; 11% J; 98% J; 2% Y. P.	2-3-4-	14-13-12	3557	3.48
23	979	6.76	5.48	77.26	773	.093	50	206	31.69	20.31	16.07	4.74	98.92	13372	4994	18366	13.66	5.10	18.76	134	37.27	28.41	98% J; 2% Y. P.	2-3	14-13	2942	3.00
24	982	6.67	5.64	75.86	759	.128	.49	223	28.93	21.67	15.47	4.40	98.54	14228	5278	19506	19.86	5.37	19.86	156	33.83	29.88	"	2-3	14-13	2498	2.54
25	1017	5.75	6.25	76.24	775	.111	.37	242	23.80	24.22	17.14	4.20	98.53	14350	6899	21249	14.11	6.78	20.89	160	43.12	29.18	"	2-	14	2702	2.66
26	1003	6.25	6.12	76.84	762	.089	.40	241	25.67	22.87	17.47	4.15	98.88	14365	5863	20228	14.32	5.85	20.17	154	38.07	26.78	"	2-3	14-13	2814	2.80
27	950	5.42	6.83	75.65	721	.100	.54	229	22.13	24.56	17.88	4.14	98.58	13654	6398	20052	14.37	6.73	21.10	128	49.98	27.91	"	2	14	2533	2.67
28	966	6.75	6.64	74.86	702	.127	.40	264	24.40	23.68	15.90	3.66	98.66	14212	5005	19217	14.71	5.18	19.89	180	27.81	28.70	"	2	14	2804	2.90
29	1006	7.01	5.85	76.76	766	.165	.36	240	28.78	21.64	17.12	4.18	98.20	15260	8977	24237	15.17	8.92	24.09	181	49.60	27.70	"	2-3-4	14-13-12	3262	3.24
30	986	6.27	7.11	74.54	732	.111	.37	254	24.03	25.59	14.30	3.88	98.67	14632	11817	26449	14.84	11.98	26.82	233	50.72	29.82	"	2	14	3073	3.12
31	989	6.94	5.48	76.60	770	.124	.56	219	30.86	21.47	13.50	4.51	98.59	13279	14185	27464	13.43	14.34	27.77	288	49.25	29.34	"	2	14	3140	3.17
Total	28722				22343			6379						528760	103358	632118				2555						71282	
Average	927	6.515	4.958	78.766	721	.106	.372	206	29.414	19.664	19.361	4.573	98.727	17057	6891	20391	18.41	7.02	22.01	170	40.45	32.736				2299	2.48
Avg. to Date	861	6.404	4.783	79.356	674	.109	.366	187	29.803	19.333	19.499	4.768	98.665	15596	6891	18316	18.11	7.02	21.27	170	40.45	33.036				2099	2.43

Magna, Utan,
February 3, 1917.

‡‡ Oils Initialed:
J—Jones.
Y P—Yaryan Pine.
S F—Smelter Fuel.
A C—American Creosote.

R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 41.

UTAH COPPER COMPANY—MAGNA PLANT

METALLURGICAL DEPARTMENT

Composite Flotation Retreatment Plant Results—Month of February, 1917

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe	HEADING % Si02	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % Si02	Ratio of Concentration	Per Cent Indicated Extraction	OIL Pounds New Oil Added	OIL Lbs. Oil in Circulation	OIL Total Oil Entering Head of Machine	OIL ORIGINAL FEED Pounds New Oil Per Ton	OIL ORIGINAL FEED Pounds Circulating Oil Per Ton	OIL ORIGINAL FEED Total Lbs. Oil Per Ton	OIL CIRCULATING FEED Total Tons	OIL CIRCULATING FEED Pounds Oil Per Ton in Circulation	OIL CIRCULATING FEED Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	REAGENT Total Lbs.	REAGENT Pounds Per Ton
1	915	7.02	4.85	78.30	729	.136	186	33.99	19.24	15.77	4.92	98.44	10382	12142	22524	11.35	13.27	24.62	259	46.88	32.03	98% J; 2% Y. P. ‡	4	12	3010	3.29
2	941	6.40	5.38	78.04	748	.108	193	30.78	20.44	16.10	4.88	98.68	8615	10654	19269	9.16	11.32	20.48	323	32.98	33.17	"	2	14	2973	3.16
3	947	6.21	6.25	74.18	727	.180	220	26.13	22.24	17.81	4.30	97.83	10007	11628	21635	10.57	12.28	22.85	325	35.78	32.14	"	2	14	2589	2.73
4	955	6.41	5.76	76.30	743	.134	212	28.44	22.26	17.04	4.51	98.40	9824	12083	21907	10.29	12.65	22.94	321	37.64	31.24	"	2	14	2925	3.06
5	1011	6.70	5.85	76.20	779	.088	232	28.93	22.59	16.00	4.36	99.02	8791	9501	18292	8.70	9.40	18.10	335	28.36	30.92	"	2	14	2777	2.75
6	943	6.34	6.58	75.10	724	.107	219	26.94	24.49	13.67	4.30	98.71	11275	6888	18163	11.96	7.30	19.26	278	24.78	32.35	98% J; 2% Y. P.; 80% J; 20% A. C.	2-4	14-12	3122	3.31
7	956	6.43	5.61	77.53	749	.095	207	29.39	22.43	14.77	4.62	98.83	13232	9317	22549	13.84	9.75	23.59	184	50.64	31.43	80% J; 20% A. C.; 87½% J; 11½% A. C.; 1% Y. P.	2-4	14-12	3233	3.38
8	985	6.30	5.77	77.40	767	.102	218	28.10	23.43	13.87	4.52	98.75	12727	9184	21911	12.92	9.32	22.24	242	37.95	31.27	87½% J; 11½% A. C.; 1% Y. P.	4-7	12-9	3624	3.68
9	992	6.61	5.34	78.10	781	.131	211	30.66	21.21	14.67	4.71	98.46	13099	10314	23413	13.20	10.40	23.60	228	45.24	30.96	"	4-6	12-10	3037	3.06
10	939	7.05	6.03	76.50	708	.129	231	28.28	22.50	15.77	4.07	98.59	11863	10749	22612	12.63	11.45	24.08	236	45.55	30.77	(87½% J; 11½% A. C.; 1% Y. P.; 42% J. (52% S. F.; 5½% A. C.; ½% Y. P.	4-6	12-10	3261	3.47
11	909	7.48	5.48	76.53	702	.106	207	32.46	21.33	13.60	4.39	98.92	12874	9555	22429	14.16	10.51	24.67	262	36.47	29.12	87½% J; 11½% A. C.; 1% Y. P.	4	12	3233	3.56
12	881	7.55	5.88	75.23	665	.103	216	30.45	22.57	12.50	4.08	99.00	12245	9194	21439	13.90	10.44	24.34	271	33.93	27.11	"	4-5	12-11	3448	3.91
13	915	6.91	7.76	74.17	678	.094	237	26.42	25.16	12.30	3.86	99.01	11687	15767	27454	12.77	17.23	30.00	273	57.75	30.38	"	4-5	12-11	3241	3.54
14	917	7.65	5.57	74.90	705	.108	212	32.66	22.06	12.77	4.32	98.92	9739	11567	21306	10.62	12.61	23.23	266	43.48	31.68	"	4-5	12-11	3448	3.76
15	958	7.13	6.60	74.20	724	.122	234	28.77	24.43	13.73	4.09	98.68	9211	15870	25081	9.61	16.57	26.18	305	52.03	31.66	"	4-5	12-11	3177	3.32
16	879	7.46	6.47	74.55	665	.127	211	30.54	23.41	11.57	4.15	98.68	8125	10232	18357	9.28	11.68	20.96	327	31.29	32.29	"	4-6	12-10	3317	3.79
17	904	7.33	6.73	73.70	677	.148	227	28.73	23.74	11.98	3.98	98.47	8885	12734	21619	9.83	14.09	23.92	334	38.12	31.02	"	4-5	12-11	3451	3.82
18	917	8.07	5.37	75.07	706	.140	211	34.58	21.06	12.10	4.34	98.67	8839	10294	19133	9.64	11.23	20.87	310	33.21	32.24	"	4-5	12-11	3714	4.05
19	924	7.20	6.70	74.23	702	.140	222	29.56	23.80	12.20	4.17	98.54	8645	11886	20531	9.36	12.86	22.22	321	37.03	33.47	"	4-5	12-11	3531	3.82
20	919	7.59	5.62	75.13	700	.161	219	31.40	21.70	14.03	4.20	98.40	8924	11272	20196	9.71	12.27	21.98	279	40.40	32.83	"	4-6	12-10	3961	4.31
21	951	7.38	6.21	75.63	719	.112	232	29.82	22.71	14.15	4.09	98.86	8738	14660	23398	9.19	15.42	24.61	296	49.53	31.90	"	4-6	12-10	3663	3.85
22	915	7.07	5.96	75.72	702	.159	213	29.87	22.85	13.60	4.30	98.28	7783	20332	28115	8.51	22.22	30.73	284	71.59	30.26	"	4-6	12-10	4319	4.72
23	916	6.83	6.09	76.27	703	.114	213	29.01	23.67	13.03	4.30	98.68	7170	15277	22447	7.83	16.68	24.51	259	58.98	30.10	"	4-5	12-11	4398	4.80
24	967	6.46	5.89	76.77	744	.120	223	27.65	23.31	14.50	4.34	98.59	7124	12631	19755	7.37	13.06	20.43	254	49.73	27.98	"	4-6	12-10	3532	3.65
25	911	6.32	6.37	76.27	699	.127	212	26.69	23.51	13.07	4.29	98.45	12067	12533	24600	13.25	13.75	27.00	176	71.21	29.64	"	4-6	12-10	3765	4.13
26	906	6.48	5.79	76.43	705	.112	201	28.78	22.01	14.70	4.50	98.65	13153	4402	17555	14.52	4.86	19.38	131	33.60	30.57	"	4-6	12-10	3550	3.92
27	956	6.79	6.09	76.13	722	.094	234	27.48	22.31	16.08	4.09	98.92	14107	4741	18848	14.76	4.96	19.72	143	33.15	29.98	"	6-8	10-8	3307	3.46
28	980	6.73	6.78	74.07	718	.102	262	24.92	23.58	14.62	3.74	98.92	17476	6205	23681	17.83	6.33	24.16	150	41.37	30.08	"	6-8	10-8	3293	3.36
Total	26206				20091		6115						296607	311612	608219				7372						94899	
Average	936	6.9161	6.028	75.808	717.5	.1212	218.4	29.241	22.637	14.143	4.294	98.655	10593	11129	21722	11.32	11.89	23.21	263	42.27	31.021				3389	3.62
Avg. to Date	893	6.636	5.337	77.779	693	.114	200	29.587	20.861	17.022	4.519	98.666	13474	6288	19762	15.09	7.04	22.13	150	41.92	32.140				2646	2.96

‡ Oils Initialed:
J—Jones.
Y P—Yaryan Pine.
S F—Smelter Fuel.
A C—American Creosote

Magna, Utah,
March 2, 1917.

R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 42.

UTAH COPPER COMPANY—MAGNA PLANT

METALLURGICAL DEPARTMENT

Composite Flotation Retreatment Plant Results—Month of March, 1917

DATE	HEADING Dry Tons	HEADING % Cu.	HEADING % Fe.	HEADING % SiO2	TAILING Dry Tons	TAILING % Cu.	CONCENTRATE Dry Tons	CONCENTRATE % Cu.	CONCENTRATE % Fe.	CONCENTRATE % SiO2	Ratio of Concentration	Per Cent Indicated Extraction	OIL Pounds New Oil Added	OIL Lbs. Oil in Circulation	OIL Debit	OIL Credit	OIL Total Oil Entering Head of Machine	ORIGINAL FEED Pounds New Oil Per Ton	ORIGINAL FEED Pounds Circulating Oil Per Ton	ORIGINAL FEED Total Lbs. Oil Per Ton	CIRCULATING FEED Total Tons	CIRCULATING FEED Pounds Oil per Ton in Circulation	CIRCULATING FEED Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	REAGENTS Total Lbs.	REAGENTS Pounds Per Ton
3/1	1 011	6.77	5.45	77.43	772	.087	239	28.37	20.90	17.27	4.23	99.01	15675	6988		6988	22663	15.50	6.91	22.41	149	46.90	25.13	87½% J., 11½% A. C., 1% Y. P.**	6-7	10-9	3188	3.15
2	954	6.66	4.78	78.80	754	.086	200	31.43	20.04	15.47	4.77	98.95	15147	5482		5482	20629	15.87	5.75	21.63	109	50.29	27.43	"	6-8	10-8	3486	3.65
3	1 054	6.33	4.61	79.30	826	.072	228	29.02	21.11	17.57	4.62	99.13	17188	6216		6216	23404	16.30	5.90	22.20	136	45.71	28.49	86% J., 12½% A. C., 1½% Y. P.	6-8	10-8	3136	2.98
4	995	6.18	5.69	77.50	763	.177	232	25.89	21.29	18.47	4.28	97.80	17989	5333	2240	3093	21082	18.08	3.11	21.19	112	47.62	30.91	Lyoth Fuel Oil.	6-7	10-9	3839	3.86
5	1 006	6.83	5.70	76.37	758	.220	245	27.09	21.40	19.37	4.06	97.66	18845	7079	2740	4339	23184	18.73	4.31	23.04	137	51.67	31.06	" " "	6-8	10-8	4661	4.63
6	986	6.43	5.39	78.80	772	.208	214	28.91	20.68	17.43	4.61	97.45	16913	6994	2060	4934	21847	17.15	5.00	22.15	103	67.90	32.02	" " "	6-10	10-6	4092	4.15
7	1 024	7.80	5.69	75.50	763	.189	261	30.04	19.30	18.47	3.92	98.20	16819	8223	2780	5443	22262	16.42	5.32	21.74	139	59.16	29.31	" " "	6-7	10-9	3834	3.74
8	1 080	7.97	5.96	74.80	800	.243	280	30.06	21.26	15.43	3.86	97.77	17327	6594	2360	4234	21561	16.04	3.92	19.96	118	55.88	32.56	" " " & 59% L. F., 41% J.	6-11	10-5	4311	3.99
9	1 111	6.66	6.92	74.50	835	.183	276	26.25	23.15	16.07	4.02	97.93	18063	7606	2760	4846	22909	16.26	4.36	20.62	138	55.12	34.18	59% Lyoth Fuel & 41% J.	7-11	9-5	4511	4.06
10	1 057	7.43	6.32	75.00	782	.206	275	27.93	22.86	14.43	3.84	97.96	17297	9641	2540	7101	24398	16.36	6.72	23.08	127	75.91	29.19	59% L. F., 41% J.; 86% J., 12½% A. C. 1 ¼% Y. P.	6-6	10-8	4216	3.99
11	1 060	7.14	6.25	75.67	772	.144	288	25.92	21.93	17.88	3.68	98.53	17404	13982	3840	10142	27546	16.42	9.57	25.99	194	72.07	28.84	86% J., 12½% A. C., 1½% Y. P. 43% L. F. 43% J. 12½% AC 1½% Y. P.	8-9	8-7	3546	3.34
12	1 044	7.68	5.74	76.18	762	.100	282	28.15	19.18	22.72	3.70	99.07	18030	12586	3700	8886	26916	17.27	8.51	25.78	185	68.03	26.14	43% J., 43% L. F. 12½% A. C., 1½% Y. P	6-9	10-7	3062	2.93
13	988	7.25	5.64	76.00	748	.134	240	29.36	20.46	17.50	4.11	98.58	17114	13267	3800	9467	26581	17.32	9.58	26.90	190	69.83	26.43	43% J., 43% L. F. 12½% A. C., 1½% Y. P	6-10	10-6	3419	3.46
14	965	6.25	5.73	77.03	751	.073	214	27.91	21.91	15.47	4.51	99.08	14695	18453	3200	15253	29948	15.23	15.81	31.04	160	115.33	25.93	"	6-8	10-8	2912	3.02
15	954	5.87	5.45	77.83	760	.083	194	28.56	22.07	17.37	4.92	98.86	12958	12720	2900	9820	22778	13.58	10.29	23.87	145	87.72	25.57	"	6-8	10-8	2902	3.04
16	942	5.76	5.75	78.13	738	.102	204	26.25	23.47	14.53	4.62	98.60	11851	9594	2460	7134	18985	12.58	7.57	20.15	123	78.00	25.29	"	6-8	10-8	2403	2.55
17	958	6.00	5.70	77.33	738	.130	220	25.67	22.08	18.60	4.35	98.37	11559	12028	2800	9228	20787	12.07	9.63	21.70	140	85.91	26.06	"	6-8	10-8	2617	2.73
18	964	5.96	6.04	77.30	748	.104	216	26.24	22.23	17.17	4.46	98.65	12428	10831	2840	7991	20419	12.89	8.29	21.18	142	76.27	26.44	"	6-8	10-8	3060	3.17
19	1 031	6.11	5.94	76.12	789	.164	242	25.50	22.38	17.63	4.26	97.93	12768	11656	3520	8136	20904	12.38	7.89	20.27	176	66.23	26.98	"	6-10	10-6	3961	3.84
20	1 019	7.04	5.87	76.10	779	.123	240	29.44	20.48	17.10	4.24	98.64	13654	8420	2720	5700	19354	13.40	5.59	18.99	136	61.91	27.57	"	6-9	10-7	4056	3.98
21	1 043	6.39	6.60	76.15	799	.111	244	26.97	22.15	14.95	4.28	98.66	16633	7305	2160	5145	21778	15.95	4.93	20.88	108	67.64	26.70	82½% Fuel and 17½% A. C.	7-8	9-8	4153	3.98
22	986	6.10	5.52	77.87	775	.092	211	28.19	20.84	16.60	4.68	98.83	15706	7661	1960	5701	21407	15.93	5.78	21.71	98	78.17	25.56	"	5-8	11-8	2656	2.69
23	1 090	6.40	5.55	78.37	860	.095	230	29.94	20.66	15.08	4.73	98.85	15938	6924	1960	4964	20902	14.62	4.55	19.17	98	70.65	26.83	"	6-8	10-8	2411	2.21
24	1 052	6.35	6.08	77.13	814	.134	238	27.62	22.76	13.60	4.42	98.40	16326	7352	2180	5172	21498	15.52	4.92	20.44	109	67.45	28.24	"	8-10	8-6	3229	3.07
25	1 075	6.43	6.25	75.90	829	.241	246	27.29	23.27	13.27	4.37	97.12	11473	7589	1680	5909	17382	10.67	5.50	16.17	112	67.76	31.39	50% J., 37½% F., 12½% A. C.	4-5	12.11	3864	3.59
26	1 083	6.77	5.95	75.93	833	.278	250	28.45	22.00	14.63	4.34	96.85	11960	6776	1575	5201	17161	11.04	4.80	15.84	105	64.53	32.94	"	4-5	12.11	3990	3.68
27	1 021	6.08	6.51	76.13	777	.249	244	24.65	22.86	16.90	4.18	96.83	16669				16669	16.33		16.33			32.51	"	All	None	4698	4.60
28	1 013	6.24	7.05	74.73	749	.300	264	23.12	24.01	16.80	3.84	96.42	16622				16622	16.41		16.41			32.64	"	"	"	4741	4.68
29	959	6.78	6.22	75.90	705	.198	254	25.09	22.08	20.07	3.78	97.81	14456	1514	840	874	15130	15.07	.71	15.78	42	36.04	33.44	"	4-16	12-0	3887	4.05
30	750	5.69	5.25	78.13	590	.589	160	24.39	20.10	25.40	4.67	91.88	7974				7974	10.63		10.63			40.52	"	All	None	3584	4.78
31	991	6.05	6.41	75.10	764	.486	227	24.75	23.51	18.17	4.36	93.80	7871	3045	680	2365	10236	7.94	2.39	10.33	68	44.78	36.27	"	5-6	11-10	3553	3.58
					23915		7358						465352	241859	62295	179561	644916				3599						111975	
Total	31 266																											
Average	1 008.58	6.580	5.871	76.678	771.4	.1774	237.4	27.371	21.691	17.143	4.261	97.894	15011	8638	2010	5792	20803	14.837	6.343	21.180	116	49.89	29.438				3612	3.581
Avg. to Date	930	6.610	5.522	77.397	718	.137	212	28.794	21.158	17.065	4.335	98.395	13965			6129	20094	15.02	6.59	21.61	139	44.09	31.203				2955	3.177
													465352+241859=				707211										

** Oils Initialed:
L F—Lyoth Fuel.
J—Jones.
Y P—Yaryan Pine.
A C—American Creosote.

Magna, Utah.
April 8, 1917.

R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 43.

UTAH COPPER COMPANY—MAGNA PLANT
METALLURGICAL DEPARTMENT
Composite Flotation Retreatment Plant Results for Period—April 1st and 7, 1917—Inclusive

	HEADING				TAILING		CONCENTRATE																	
DATE	Dry Tons	% Cu.	% Fe.	% SiO2	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% SiO2	Per Cent Indicated Extraction	Ratio of Concentr'n	Pounds New Oil Added	Lbs. Oil in Circulation	Excess Lbs. Circulating Oil	Total Lbs. Oil, New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Lbs. Excess Circulating Oil Per Ton	Total Lbs. Oil Per Ton, New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
4/1	1098	6.21	6.65	74.80	806	.560	292	21.78	21.98	22.63	93.4[illegible]	3.76	5666			5666	5.16			5.16		37.99	3595	3.27
2	1086	7.14	5.74	76.27	839	1.277	247	27.09	19.58	23.32	86.1[illegible]	4.40	4418	354	99	4517	4.07	.33	.09	4.16	51	35.93	3404	3.13
3	1095	6.23	6.43	76.77	814	.127	281	23.91	22.65	19.47	98.45	3.90	18450	3310	1430	19880	16.85	3.02	1.31	18.16	94	32.20	3396	3.10
4	1090	5.67	6.22	77.68	830	.116	260	21.38	22.44	19.33	98.41	4.19	19527	5019	2959	22486	17.91	4.60	2.71	20.62	103	32.92	2922	2.68
5	1104	5.66	6.66	77.10	827	.164	277	22.07	22.89	20.47	97.82	3.99	21499	4010	1430	22929	19.47	3.63	1.30	20.77	129	30.41	3803	3.44
6	1077	6.15	5.41	78.40	828	.243	249	25.76	21.44	20.50	97.00	4.32	21829	5177	2617	24446	20.27	4.81	2.43	22.70	128	27.93	4275	3.97
7	1039	7.46	5.48	77.40	789	.307	250	30.10	19.96	18.57	96.89	4.16	21012	2948	1068	22080	20.22	2.83	1.03	21.25	94	27.51	4628	4.45
TOTAL	7589				5733		1856						112401	20818	9603	122004					599		26023	
AVERAGE	1084	6.351	6.092	76.910	819	.401	265	24.731	21.618	20.625	95.230	4.089	16057	2974	1372	17429	14.811	2.743	1.265	16.076	86	32.165	3718	3.429

Magna, Utah,
April 8, 1917.

R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT
FLOTATION OPERATIONS
Retreating Vanner Concentrate Products

PERIOD	FLOT. HEADS Tons	FLOT. HEADS Assay % Cu.	FLOT. CONCTS. Tons	FLOT. CONCTS. Assay % Cu.	Tails Assay % Cu.	Flotation Copper Appr. %	Flotation Recovery Estm. %	New Oils Lbs. Per Ton	Oil Assays Flotation Heads Including Circul. Load	Percents Concts.	Percents Tails
1914											
4th Quarter	8821	6.87	1892	29.78	.617	92.94	92.94	4.31			
1915											
1st Quarter	17849	6.42	3752	28.94	.425	94.76	94.76	3.47			
2nd Quarter	8802	5.60	1702	27.38	.397	94.28	94.28	5.28			
3rd Quarter	17328	5.73	3797	24.17	.554	92.45	92.45	4.92			
4th Quarter	19558	6.12	4200	26.44	.574	92.64	92.63	4.42			
YEAR	63537	6.029	13451	26.61	.502	93.439	93.436	4.41			
1916											
1st Quarter	20190	4.967	3629	25.37	.490	91.80	91.80	3.34			
2nd Quarter	22750	5.460	4362	26.62	.441	93.47	93.47	3.23			
3rd Quarter	22750	5.840	4767	26.59	.316	95.73	95.73	3.22			
4th Quarter	27275	6.099	6086	26.38	.273	96.52	96.52	3.54			
YEAR	92965	5.630	18864	26.30	.375	94.69	94.69	3.36			
1917											
January	9300	6.24	2267	23.99	.456	94.48	94.48	20.02			
February	8550	6.63	2289	23.63	.422	95.33	95.33	18.77	1.07	2.87	.10
March	11063	6.70	3377	21.07	.368	96.19	96.19	21.19	.97	3.15	.033
1st Quarter Average	28913	6.531	7933	22.76	.412	95.42	95.42	20.10	1.01	3.03	.062

(Signed) E. W. ENGELMANN,
Flotation Foreman.

Hayden 3/29/1917
Copied Butte 4/15/1917

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

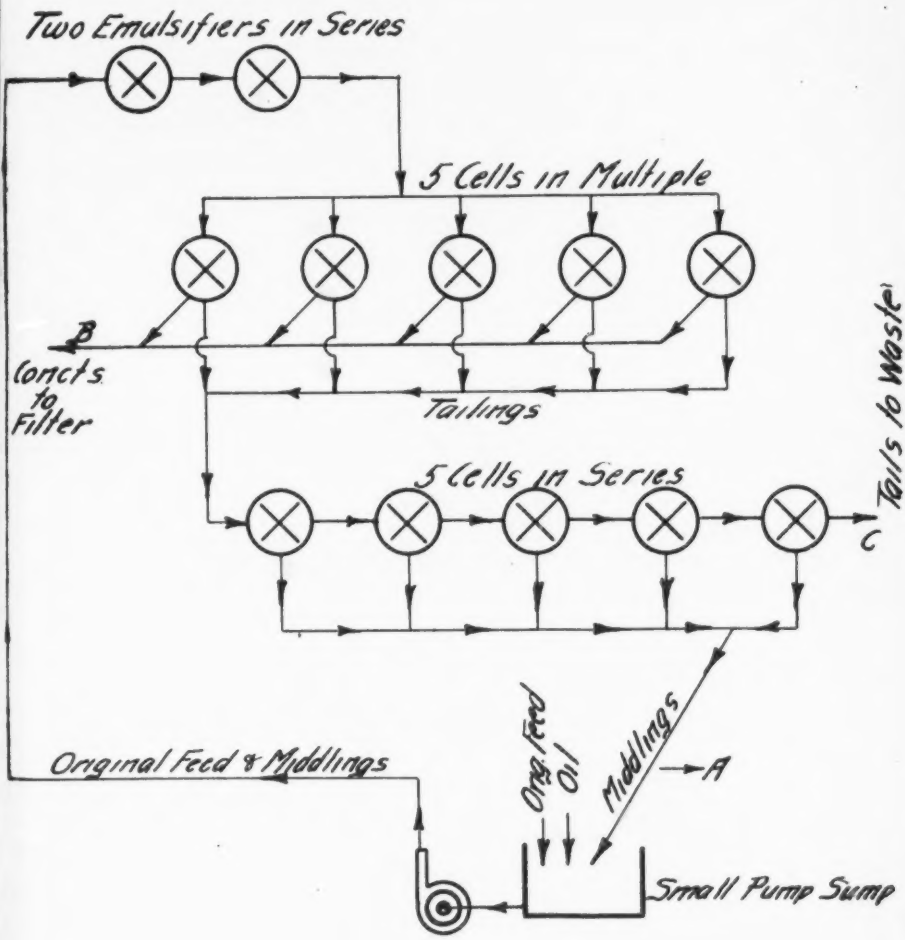
Butte & Superior Mining Company.

Defendant's Exhibit No. 44.

5033

Defendant's Exhibit No. 45.

RETREATING MACHINE-MECHANICAL AGITATION JANNEY TYPE



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5035 Plaintiff's Exhibit No. 46.

Disclaimer.

835,120—Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard, and John Ballot, London, England. Ore Concentration. Patent Dated November 6, 1906. Disclaimer Filed March 28, 1917, by the Assignee, Minerals Separation, Limited.

"Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

(Official Gazette, April 3, 1917.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

[On left margin:] Disclaimer in Letters Patent No. 835,120.

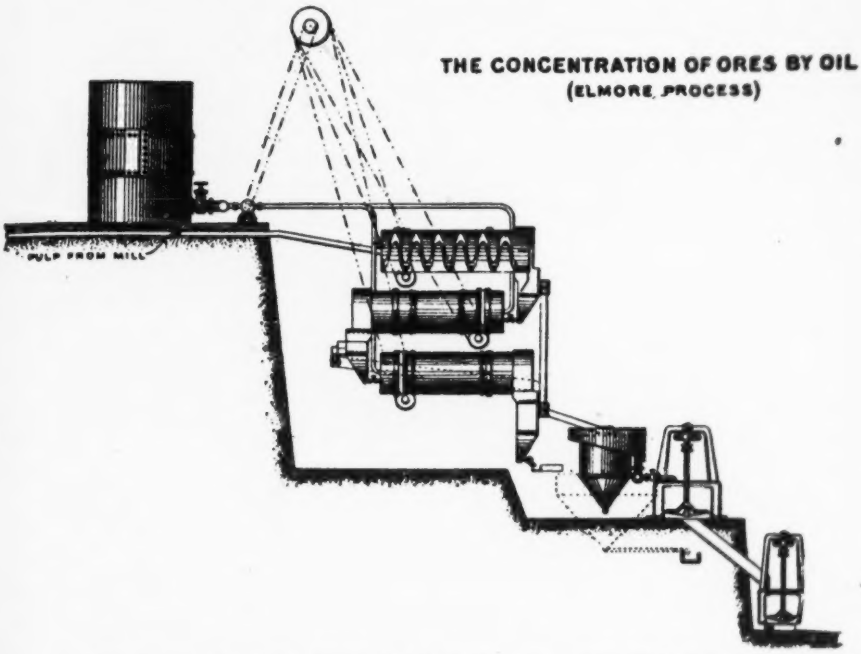
5036 Defendant's Exhibit No. 47.

From the California Journal of Technology, November, 1903.

Experiments on the Elmore Process of Oil Concentration.

By W. F. Copeland, Min., '03; Drury Butler, Min., '03; Jas. H. Wise, Min., '03.

Inasmuch as the fundamental ideas underlying the Elmore Process of Oil Concentration are comparatively new, a brief outline of the process as it is in actual operation will first be given.



The process depends upon the fact that minerals with a metallic lustre, when treated in the form of a wetted pulp, adhere to oil, while earthy minerals do not. Two distinct operations are involved; first the separation of the metallic mineral from the gangue by
5037 means of the oil; second the extraction of the mineral from the oil.

The ideas underlying the first operation were patented by John Turnbridge of Newark, N. J., in 1878. In 1886 Carrie J. Everson, of Chicago, contributed the idea that the concentration was aided by the presence of an acid solution, and patented the same. But the absence of a successful method of separating the mineral from the oil prevented the practical application of these early patents. Burning the oil was tried, but this left a difficult residue to treat, and the large consumption of oil made the method too expensive. Settling the mineral out by thinning the oil with gasoline, ethers, carbon bisulphide, etc., also proved too expensive, and it was not until July, 1900, that this difficulty was overcome, when Mr. Francis E. Elmore, of Leeds, England, accomplished the separation by means of a centrifugal machine, similar in most respects to those used in sugar factories and in milk and cream separation. This contribution by Mr. Elmore, then, made the process feasible.

The plant, designed by the Oil Concentration Syndicate, and now in successful operation, is shown in the accompanying cut. This plant consists of oil supply tank, long horizontally rotating cylinders,

each containing a fixed helical screw inside, separating devices at the end of each cylinder, receiving tanks for mineral laden oil, centrifugal separators, etc.

5038 The pulp and oil are charged into cylinder No. 1, at "A," simultaneously. By slowly rotating the cylinder the pulp and oil are brought into thorough contact and carried forward at the same time. From cylinder No. 1 the material is continually discharging into separator No. 1. (These separators are Spitzkasten or hydraulic separators.) Here the mineral laden oil is floated off. The tailings are drawn off at the bottom of the separator and charged into cylinder No. 2 with more oil, and thus the treatment is repeated as many times as necessary, three usually being sufficient. From the last separator the tailings go to the tailings heap. The mineral laden oil collected from all the separators is carried to a large receiving tank "B." Here, after being heated in order to thin it and overcome its viscosity, the oil is charged into centrifugal machines, where the concentrates are separated out; the oil freed from its load of mineral, is pumped back to the original storage tank to be used again.

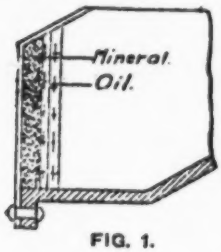


FIG. 1.

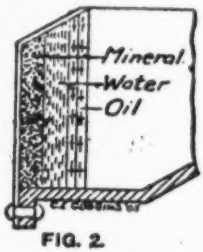


FIG. 2.

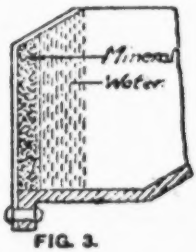


FIG. 3.

5039 The oil commonly used is a heavy residuum of consistency of ordinary cylinder oil, with specific gravity about .9, and hence the maximum load it can carry and still float in water is from 100 to 200 lbs. per ton. Usually about a ton of oil is kept in operation for each ton of ore, but the losses of oil are small, the recovered oil being used over and over again. With the treatment in the above mentioned plant it is claimed that the losses are not greater than from one to three gallons of oil per ton of ore.

Centrifugal Separator (See Fig. 4).

The theory of the separator is illustrated in figures No. 1 to No. 3 inclusive. The oil laden with its mineral (heated to 100°-150° F.) is charged into the centrifugal basket. (C or B, Fig. 4.) When the basket is rotated at high speed (about 5000-6000 peripheral feet per minute) the charge arranges itself according to the specific gravities of the particles, the heavy ones seeking the periphery, as shown in Fig. 1. Water is then added, and this, due to its specific gravity, takes place between the oil and the mineral. Sufficient water is added to displace all the oil, which latter is discharged over the lip of the basket, and collected in a receiver.

If a small quantity of hot water precedes the charge of mineral laden oil, the mineral particles, on seeking the periphery, have to pass through the water and are thus more completely freed from the oil. This idea is illustrated in Fig. 3.

The concentrates are then dried in a second basket (1, Fig. 4) with porous periphery and filter bag. (E, Fig. 4.)

5040 Laboratory Methods.

In making a test, the ore is first crushed to the desired fineness, and the proper charge is thoroughly wetted in the solution to be used (usually water), thus forming a thin pulp. The oil is next added and the whole charge thoroughly mixed. This mixing, or agitation, can be done in two different ways. The charge may be agitated very gently, the oil being kept in a single lake, and broken up as little as possible consistent with a thorough contact of pulp and oil; or the

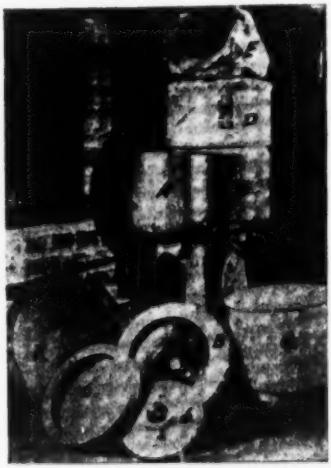


Fig. 4.

Fig. 5.

charge may be agitated so violently as to dash the oil up into a foam or froth full of air bubbles; thus a very thorough contact of oil and pulp is obtained. Each method has its advantages and disadvantages, and these are discussed later.

5041 At first the mixing was performed in a galvanized iron mixer. The mineral laden oil was then skimmed off with an aluminum ladle. (Aluminum, if thoroughly wetted, does not adhere to the oil. To wet the same thoroughly, first wash, then dip in strong sulphuric acid, and then wash in water.)

The roughness of the aluminum mixer and the affinity of the oil for the metallic surface makes a thorough clean-up after each test

difficult, hence a large clean-up error is always introduced by this method.

Glass, however, behaves towards oil just as the non-metallic gangue does, (glassware is cleaned up and surface wetted the same as aluminum), and by the use of ordinary percolating tubes, such as shown in figure No. 5 (A and B), the clean-up error may be entirely eliminated. With these, the tailings may be drawn off at the bottom and oil at the top, as desired. Three methods of mixing may be used. 1. By inverting the tube several times, thus allowing the ore to fall through the oil. 2. By rotating the tube in a horizontal position, thus throwing the pulp up on to the surface of the lake of oil. 3. By violently shaking the tube, thus producing the foam effect, or at least shattering the oil into small globules. The charge having been thoroughly mixed, the tailings are allowed to settle, solution is added to float the oil to the top of the tube, whence it may be floated off as shown in figure No. 6.

5042 The mineral laden oil is then heated and treated in the centrifugal separator as above described. For small tests, a shallow basket, such as is shown at C, in figure No. 4, may be used.

The solution used in the concentration is a matter of some importance. Water is, of course, used whenever possible, but certain other solutions have important advantages. As before stated, an acid solution is found advantageous. It cleans the metallic surfaces, by dissolving the metallic oxide coatings that may have formed on them. It increases the specific gravity of the solution, and it aids in producing the foam effect which is due to the generation of certain gases.

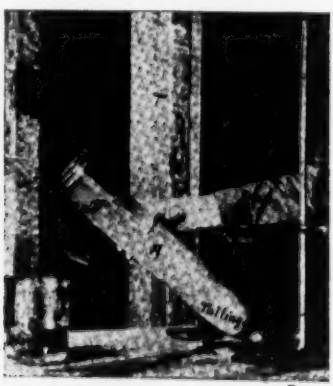


Fig. 6.

As before stated, the specific gravity of the average oil used is about .9 and water .1, leaving a difference of about .1 for buoyancy or carrying capacity of the oil. The idea at once suggests itself that if a denser solution be used, the carrying power of the oil will

be increased correspondingly. A salt (NaCl) solution, for
5043 instance, gives excellent results. A saturated solution of NaCl at 20° C., containing about 27% NaCl, has a specific gravity of 1.204. This gives a difference of .3 between the specific gravities of the oil and of the solution, and a carrying capacity of the oil three-fold greater than with water alone. Not only does it give a greater buoyancy to the oil, but it also aids materially in producing the foam effect, and probably aids in brightening the metallic surfaces.

The phenomena of overloading is so vital in the practical application of the process, as well as in the laboratory tests, that it must be thoroughly understood. With oil of specific gravity .9 the maximum possible load of mineral it can carry in water is 200 pounds per ton, while in a saturated salt solution it is 600 pounds per ton. If these limits are exceeded the oil is said to be overloaded and sinks. But it is not necessary that the whole mass of oil in any particular case be charged to this extent in order that overloading take place. If a charge of oil and mineral, safe within the above limits, be allowed to stand, the mineral will settle to the bottom of the oil, and hence in the lower portions of the oil the percentage of mineral may exceed the safe limits. In case the overloading is sufficient to overcome the surface tension of the oil, small masses separate away from the main mass and sink. It is evident, then, that the time allowed for the gangue to settle out of the oil should not be long enough to
permit the overloading to take place. Small globules of oil
5044 separated from the main mass in agitation may also become overloaded.

Tests—Molybdenite Ore.

The ore treated was low grade, with the values fairly well disseminated. The gangue minerals were orthoclase and quartz. Samples were crushed to 20, 30 and 40 mesh, and treated in percolating tubes as outlined above. The details and results are given in the following table:

Molybdenite.

No. of exp.	Wt. ore treated.	Mesh.	Total amt. of oil used.	No. of treat.	Value conc. % M_oS_2.	Value tails % M_oS_2.	% of extrac.
1.....	2 kg.	20	2400	4	23.9	.92	6.30
2.....	2 kg.	30	2900	3	23.2	.81	67.6
3.....	1 kg.	40	1200	3	17.4	.82	67.2
4.....	100 gms.	30	2.1	1	32.4	1.41	43.5
5.....	100 gms.	30	5.3	2	32.4	1.30	47.0
6.....	100 gms.	30	8.9	3	32.4	.62	75.0
7.....	...	30	3.	1	47.9	....	....
8.....	...	30	3.	3	27.6	....	....
9.....	...	30	3.	1	50.0	....	.....

Experiment No. 1 showed the presence of middlings, requiring finer crushing to liberate the sulphide. Experiments No. 2 and No. 3 gave practically the same percentage of extraction, but the concentrates in No. 3 were much lower grade than in No. 2. A comparison of values of concentrates in No. 1, No. 2 and No. 3 shows clearly that although the finer crushing has freed the MoS_2 from the gangue, at the same time it has produced a larger percentage of fine gangue which, becoming mechanically occluded in the oil, gives a low grade concentrate.

5045 Experiments No. 4, No. 5 and No. 6 show the results obtained by treating separate samples with small quantities of oil, in a salt solution, and agitating violently to produce the foam effect. This method gives the highest grade concentrates of any of the direct treatments here outlined. In experiment No. 6 only about 10 cc. of oil was used for 100 grams of ore. This gave an extraction of 75% with concentrates running 32.4% MoS_2.

But these concentrates were not marketable. In practice they would have to be reconcentrated. The results of a few reconcentration tests follow.

Samples of concentrates running about 26% MoS were agitated in a sulphuric acid solution 15 minutes. This agitation caused considerable of the occluded gangue to free itself. A small quantity of oil was then added and the material reconcentrated, utilizing the foam effect. In No. 9 a concentrate running 50.02 MoS_2 was obtained. Concentrates such as these would probably be marketable. In experiment No. 8 reconcentration was tried without the agitation in sulphuric acid solution, but the results were unsatisfactory.

The experiments on molybdenite ores are of interest because the sulphide of molybdenum has lately come into prominence in the manufacture of molybdenum steel, and also because of the fact that all previous methods of concentration other than hand sorting, have failed in its case.

5046 Copper Ores.

The ore treated was the raw product taken directly from a mine in Calaveras County, near Copperopolis. It consisted of chalcopyrite, bornite and pyrite, with a chlorite and amphibolite schist gangue. The copper values were contained in the chalcopyrite and bonite.

A 6 Kg. charge of the ore, previously ground to 40 mesh, was jigged to remove the coarse material; the products being heads, middlings and tails. 1.2 Kg. of the jig tailings was given the following treatment. The charge was thoroughly mixed and wetted in a large percolating tube with about 700 ccs. of water; 5,000 ccs. of oil were then added and the whole was gently agitated for 20 minutes. After standing for several minutes the mineral laden oil was floated off, warmed, run through the separator and parted as previously explained. A careful assay of the different products shows the following very satisfactory results:

		Weight.	% Cu.	Cu. content.	% extrac.
	Ore	6000 gms.	2.73	163.8 gms.	
Wet Conc'n	Heads	575 gms.	4.88	28.05 gms.	16.7
	Mids	800 gms.	4.66	37.28 gms.	22.3
	Tails	4625 gms.	2.19	101.28 gms.	60.8
	Oil Conc.	175 gms.	13.05	22.83 gms.	90.8
	Oil Tails	1025 gms.	.23	2.35 gms.	9.3

From the above table it is readily seen that over 60% of the copper content lies in the jig tailings, and of this 90% can be extracted by the oil concentration method, with a ratio of concentration of 7:1.

Summarizing the above facts it is seen that by means of
5047 the oil concentration method a total (i. e. including jig heads and middlings, and oil concentrates) of 94.2% of the copper in the raw products is recovered, and the bulk of the material containing this copper is but 25.8% of the original ore charge taken.

Gold Ores.

1. Auriferous Black Sands.—Before treating a sample of the auriferous sand, separate samples of the black sand and of free gold were tested to determine the relative affinity of the oil for each.

(*a*) Magnetic black sands from Cape Mendocino, consisting of magnetite with some quartz and pyrite, were run through a magnetic separator to separate out the magnetite. The latter was treated with oil and, contrary to expectations, the oil, when cold, united readily with the black sand, but dropped it on being warmed. Black sands from Nevada County Hydraulic Mines were treated in the same way, but in this case the black sand showed very little affinity for the oil.

(*b*) A sample of very fine flour gold from Klondyke undercurrents was next treated. When cold and viscous the oil took up the gold very readily, but on being warmed dropped most of it, just as in the case of the Mendocino black sands.

A sample of rusty flake gold obtained from the Nevada county
black sands by panning was next tested with water and oil as
5048 above. The oil showed very little affinity for the gold in this condition, and the few flakes that were picked up soon dropped. In order to brighten the flakes and remove the rust, a dilute solution of sulphuric acid was used in place of water, but again the gold was only partly taken up by the oil. A dilute solution of potassium cyanide was next tried on a fresh sample of gold flakes, but no improvement was noticed. The flakes were next lightly coated with mercury and in this condition they were readily taken up by the oil.

(*c*) A test was made upon mercury to see how the oil would act upon it. When in the condition of coarse globules, the mercury was not taken up by the oil. Upon violent agitation, however, the mercury floured, and in this condition was readily picked up by the oil.

The tendency toward overloading the oil was strong on account of the high specific gravity of the mercury, and much oil had to be used.

2. Quartz Gold Ores.—(*a*) A representative sample of unoxidized mother lode ore was obtained from Tuolumne county. About 75% of the values were in the sulphurets, as shown by amalgamation and concentration at the time. The ore, crushed to 40 mesh, was treated in a ½ sulphuric acid solution with oil in the ratio of 1000 cc. of oil per kilo of ore. Owing to lack of facilities at the mine, where these tests were made, the concentrates could not be separated from the oil, hence the extraction was determined by the method of difference.

5040 *Tuolumne Ore.*

The original ore assayed gold	$2.26 per ton
The tailings assayed	.31 per ton
Extraction	1.95 per ton

or 86.28% or original assay value of ore. This compares favorably with the total average extraction of 80% to 90% obtained by amalgamation and concentration at the mine.

(*b*) Two samples of ore were received from a mine near Folsom, Cal. The ore consisted of quartz with a small percentage of pyrite and chalcopyrite and some free gold. The sulphurets were badly oxidized. The treatment and results obtained are shown in the table following:

Folsom Ore.

Mesh.	Wt. ore.	Vol. oil. cc.	Wt. conc.	Value. Ore.	Conc.	Tails.	% of extrac.
30....	500 gm.	500	24	$21.50	$105.80	$11.57	23.6
30....	500 gm.	500	58	21.50	151.36	8.46	81.7
50....	500 gm.	500	52.5	21.50	157.00	7.86	76.6
50....	500 gm.	500	48.5	21.50	185.08	3.52	83.7
30....	1000 gm.	1000	20.5	39.50	257.50	17.45	27.4
60....	100 gm.	100	10	31.50	240.00	12.00	60.7
80....	100 gm.	100	12	39.50	255.00	9.40	77.5

No. of treatments in each case, 3.

Solution used in Nos. 1, 3, 5, 6, 7, was water; in Nos. 2 and 4 it was 1% H_2SO_4.

Weight tails = weight ore — weight concentrates.

(*c*) A sample of gold ore from Tuolumne County, Cal., containing quartz, molybdenite, pyrite and some telluride and free gold was treated. The presence of molybdenite made amalgamation very

difficult. The sample, crushed to 30 mesh and treated in water with oil, gave the following extraction:

Ore wt.	Val. ore.	Wt. conc.	Val. conc.	Wt. tails.	Val. tails.	Ratio conc.	% ex.
46 gm.	$32.79	4.1	$140.26	41.2	$16.40	9.4:1	55.2

5050 Silver Ores.—A small test was made on a sample of Ruby silver ore from Tonopah. The silver values consisted of proustite, pyrargyrite and some horn silver.

The original ore assayed gold	$102.25
Silver	250.82
	$422.07
The sample was concentrated in a 20% NaCl solution yielding tails which assayed gold	36.17
Silver	73.12
	$109.29
The oil concentrates assayed gold	$547.75
Silver	1092.25
	$1640.00 per ton

Although the tailings were high, yet 80% of the gold and 75% of the silver was extracted. Further investigation would probably show an improvement over these results.

Résumé.

As a conclusion to the above experiment the following suggestions and inferences are appended:

1. As Regards the Wetted Pulp.—As far as could be determined particles with either metallic or non-metallic surfaces when in the dry state, alike adhere to the oil. Furthermore, there is no affinity of oil for water as is shown by the fact that an oiled surface cannot be wetted. Hence if a metallic particle be thoroughly wetted, a water surface and not a metallic surface is exposed to the oil, and the former, as before stated, has no affinity for the oil. It is evident
5051 then that the water film must first be displaced before the oil and mineral can come in contact with each other. This displacement is hardly probable if the water film is in intimate contact with the particles, and it seems more probable that the differentiation is due to the fact that non-metallic surfaces are, and metallic surfaces are not actually wetted. If this be the case, a careful study of the relative wetting of different surfaces would be an important line of investigation.

2. The ratio of the exposed surface to the weight of the particle should be as large as possible, because the total adhesive force is in-

creased with an increase of the surface exposed to contact with the oil. This condition is best realized when the mineral breaks up into thin flakes. It is evident from this that a knowledge of the fissile character of the minerals in question is important.

3. One fundamental difficulty involved in this process is that it undertakes to concentrate and float a heavy metallic mineral, and sink the lighter gangue minerals, but this point is not necessarily fatal to the process. It is evident, however, that the heavier the gangue and the lighter and more fissile the metallic minerals, the better the ore is adapted to this method of concentration. This is a direct reversal of the ideal conditions for jig or vanner concentration.

4. Another characteristic of the process is the fact that the ratio of concentration is usually small, due to the large amount of gangue occluded by the oil and carried into the concentrates. This
5052 difficulty is increased by sliming the gangue minerals. Sliming of the metallic minerals is no disadvantage.

Foam Effect.—The foam effect is produced by a violent agitation, especially in acid or salt solutions. This throws the oil into a froth, which is heavily charged with air or gases. This gas of course gives a greatly increased buoyant force. The oil in this condition assumes a certain load of mineral and holds it in a very stable condition. The charge does not settle and overload on standing as in the case of the lake effect. The foam effect is best adapted for light, flaky minerals, such as molybdenite.

The work above outlined suggests many lines of further investigation, and as these come to be worked out, the process will become more valuable and of more general application.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(No Model.)

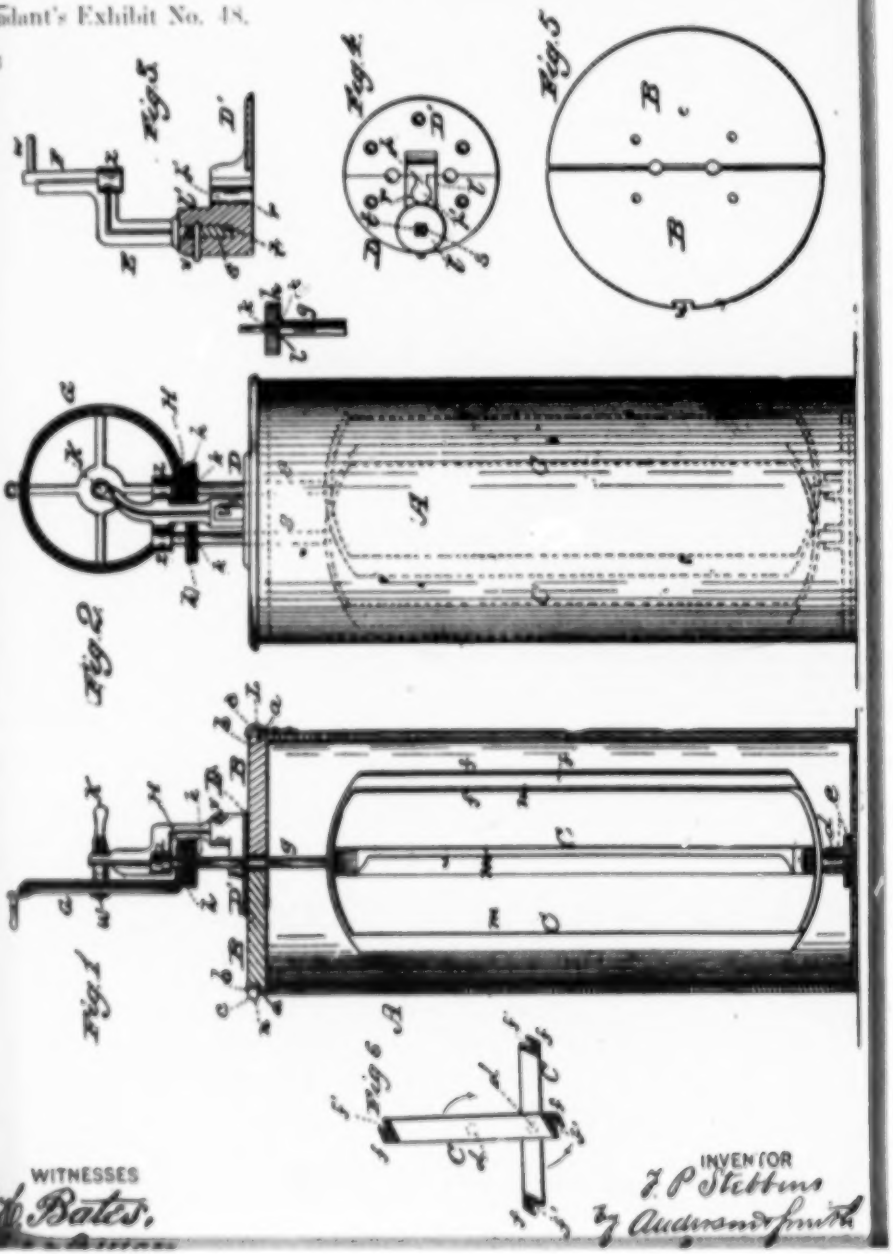
F. P. STEBBINS.

CHURN.

Patented Oct. 17, 1882.

No. 266,219.

Defendant's Exhibit No. 18.



WITNESSES

W. Bates.

INVENTOR

F. P. Stebbins

by Audrews & Smith

UNITED STATES PATENT OFFICE.

5057-1

FRANK P. STEBBINS, OF DETROIT, MICHIGAN.

CHURN.

SPECIFICATION forming part of Letters Patent No. 286,219, dated October 17, 1882.

Application filed May 13, 1882. (No model.)

To all whom it may concern.

Be it known that I, FRANK P. STEBBINS, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and valuable Improvement in Churns; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a vertical sectional view of my churn and freezer. Fig. 2 is a side view of the same, and Figs. 3, 4, 5, and 6 are detail views.

This invention has relation to churns and cream-freezers; and it consists in the construction and novel arrangement of the studded catches for the lid-sections, the separable arm or support for the drive-wheel, and its double bearing for the upper ends of the dasher-stems, the plate-sections for the lid-sections, and the socket-and-tongue connection with which they are provided, all as hereinafter set forth.

In the accompanying drawings, the letter A designates the case, which is of ordinary upright form, having a circular area in horizontal section.

B B indicate the cover-sections, each being semicircular and marginally rabbeted at *a* to form a lip, *b*, which fits within the mouth of the case, and a marginal rim-flange, *c*, which projects outward over the edge of the case.

C C represent the dashers, which are made in loop form, being cast of metal. The lower end of each loop-dasher is formed with a supporting-stem, *d*, which works in a pivot-bearing, *e*, at the bottom of the case. The upper end of each loop-dasher is formed with a vertical stem, *g*, which extends upward through a bearing at the joint of the cover-sections, and is provided with a pinion, *h*, as indicated in the drawings. The pinion is secured on the stem by means of a spline, *k*, which is cast on the stem, so that, while it is fast thereto for all purposes of communicating rotary motion, it can be easily and quickly removed. Each stem is cast with a shoulder, *l*, below the spline, on which the pinion rests. The side bars, *m*, of each loop-dasher are cast with oblique longitudinal flanges *f* on their outer edges, these flanges being turned in opposite directions on the side bars, so that the V-form channels *f'*, which lie between the flanges and the side bars, will face or open in opposite directions, as shown. The object of these channels is to aerate the milk or cream as the loops are turned. The stems of these dashers are placed sufficiently close together to allow each loop, in its rotary movement, to intersect the path of the other without interference.

D D' represent the semicircular plate-sections, which are respectively secured to the upper surfaces of the cover-sections at their middle and adjacent portions, so as to form, when closed together, an iron bearing which is concentric with the periphery of the cover. The plate D' is formed with a lug at its edge, carrying a projection, *p*, which extends across the joint of the meeting edges of the two sections, and is enlarged at its outer end, as indicated at *p'*, forming a coupling-tongue to engage a slotted socket-recess, *r*, of corresponding form, which is made in a large lug, *l'*, cast on the top of the other plate-section, D. The lug *l'* is also formed with a square socket, *s*, extending downward into its upper portion, which is designed to receive the squared tang *t* of the double bearing-arm E. A pin, *v*, passing through registering-perforations in the socket *s* and tang *t*, serves to secure the arm in its seat in such a manner that, while it is perfectly secure, it can be easily removed. This arm E is formed with two lateral bearings, *x x*, in which the upper ends or journals of the stems *g* of the dashers are seated, and with an upward and lateral extension, F, carrying a transverse bearing, *w*, for the driving gear-wheel G, which engages a bevel-pinion, H, on the stem *g*, over which the laterally-placed bearing *w* is situated, as indicated in the drawings.

K represents a transverse handle on the extension F, in rear of the bearing *w*, which is designed to enable the operator to steady the machine with one hand while turning the handle of the drive-wheel with the other. This construction is designed to form a strong and compact support for the gearing and dasher-stems, whereby the driving mechanism is maintained in proper position when the cover-sec-

5055

tions are in place and duly connected by the tongue and socket of their iron plates, and the arm F is fastened in its seat, and it permits the ready removal of the driving mechanism when the case is to be opened. In this operation the pin *v* is drawn out of the socket *s*, and the arm E, with the drive-wheel, is lifted from said socket. The pinions can then be removed from the dasher-stems, if necessary.

In order to secure the cover firmly to the case-wall, the latter is provided with the edge-hooks L, which are fastened by studs or rivets to said wall, and, projecting by their heads above the same, serve to engage the rim-flanges *d* of the cover-sections, one of which is formed with an edge-notch, *n*, to facilitate the engagement.

Having described this invention, what I claim, and desire to secure by Letters Patent, is—

1. The cover-plates D D′, having a tongue-and-socket connection, and a separable arm, E, for the drive-wheel, carrying a double bearing for the upper ends of the stems of the dashers, substantially as specified.

2. The cover-sections having the plate-sections D D′, connected by tongue *p′* and socket *r*, and the edge-hooks L of the wall engaging the rim-flanges *c* of the cover-sections, substantially as specified.

3. The combination, with the dashers C, having the splined and shouldered stems *g*, and their pinions *h* H and the drive-wheel G, of the cover-sections B, plate-sections D D′, their socket-and-tongue connection, the socket *s*, pin *v*, and removable arm E, having the lateral bearings *z*, and the extension F, substantially as specified.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

FRANK PIERCE STEBBINS.

Witnesses:
LOUIS F. GUENTHER,
ADAM E. BLOODE.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(No Model.) 2 Sheets—Sheet 1.

S. J. SULLIVAN

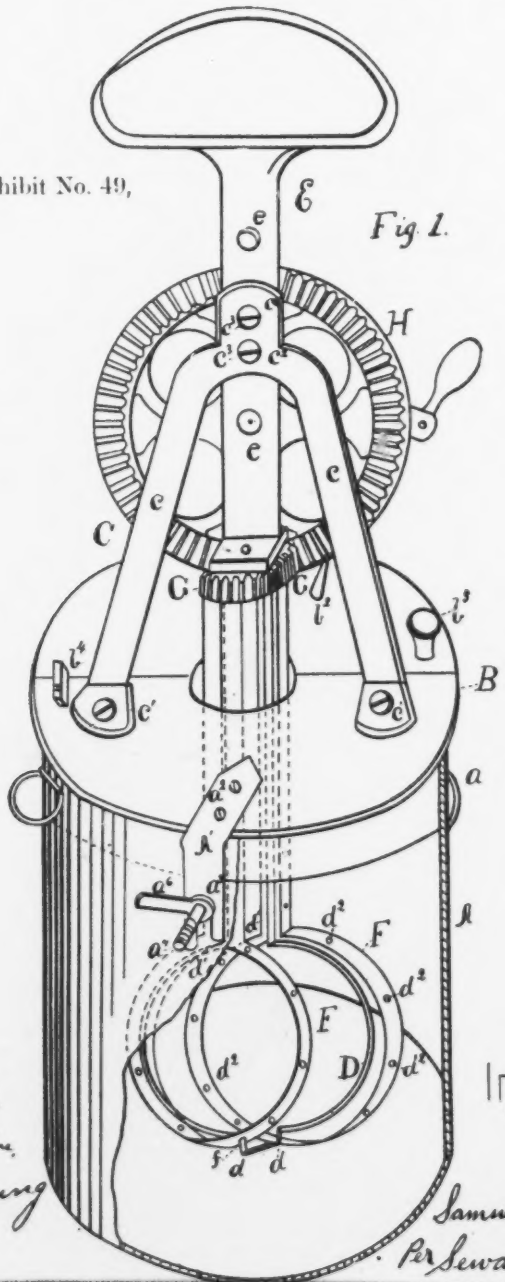
CHURN.

No. 306,441. Patented Oct. 14, 1884.

5056

Defendant's Exhibit No. 49,

Fig. 1.



Witnesses.

G. A. Hamilton.

Henry C. Young

Inventor.

Samuel J. Sullivan

Per Seward A. Hamilton

Atty

(No Model.)

S. J. SULLIVAN.

Two sheets—Sheet 2.

CHURN

No. 306,441. Patented Oct. 14, 1884.

5057

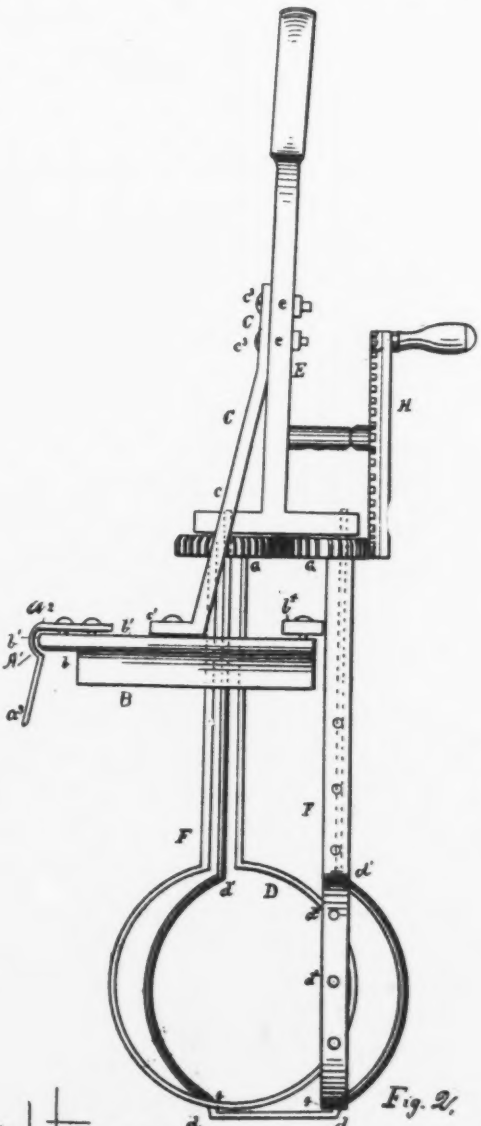


Fig. 2.

Witnesses.

G. A. Haseltine
N. A. Haseltine

Inventor

Samuel J. Sullivan
By Lewis A. Haseltine.
Attorney

173—Rec

UNITED STATES PATENT OFFICE.

5058

SAMUEL J. SULLIVAN, OF LAMAR, MISSOURI.

CHURN

SPECIFICATION forming part of Letters Patent No. 306,441, dated October 14, 1884

Application filed October 29, 1883. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL J. SULLIVAN, a citizen of the United States, residing at Lamar, in the county of Barton and State of Missouri, have invented certain new and useful Improvements in Churns, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in churns, the object of which is to provide an easy, convenient, and rapid means of churning and obtaining butter from cream, and also to provide a churn that is easily cleaned, and one simple in its construction and operation, and adapted to be used in earthen or other vessels. I attain these objects by means of the device illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a view in elevation showing the entire device, a part of the vessel being removed. Fig. 2 is a view showing the parallel dashers and adjustable support.

Similar letters of reference indicate corresponding parts in all the figures

A is a vessel made of wood, tin, stone, earthen or other suitable material and of any convenient size and shape, preferably made of wood, cylindrical in shape, and with suitable ears or handles, *a a*, for moving the churn.

B is a thick cover, preferably made of wood with a groove or rabbet, *b*, to fit closely in the top of the vessel A, the flange *b'* being projected over the edges. The cover is made with a hole in the center, and it is divided in two parts to facilitate its removal and the better to clean the dashers passing through it.

b² is a hook or latch, to hold the cover firmly to its place. The latch or latches may be upon either one or both sides.

In using an earthen vessel, I put a strap or band, *b³*, around the top, to which the hooks are attached. On wood or metal vessels I use an attachment, A′, consisting of a piece, a^2, firmly attached to the cover and extending over the flange, thence down, forming a fork, a^3, which passes on each side of a bolt, a^4, the said bolt being firmly attached to or through the vessel, and having a nut, a^5, with a thumb-piece for tightening the same, and thus firmly holding the supporting part of the cover to its position.

b⁴ is a button to swing across the place where the cover divides.

b⁵ is a knob used in raising one part of the cover.

C is a support having two spreading braces, *c c*, both attached to one and the same part of the cover by foot-pieces c' c', and an upper portion made with holes c^2 c^2, in which are placed thumb-screws or set-screws c^3 c^3, to firmly hold and adjust the dashers.

The dashers F F are constructed and operated somewhat similar to the common egg-beater, which I change and modify for use in connection with the novel devices above explained, for the objects hereinafter more fully set forth.

The dashers are constructed and placed in the vessel as follows: A strong metallic rod, D, is bent each side of and near the middle, so as to form two right angles, *d d*, for bearings for the dashers. The ends are then turned upward and inward until they form nearly a complete circle, and at points d' d', opposite to the points *d d*, the ends are bent vertically and parallel until they reach up through the cover and terminate in a handle, E. The dashers are made of thin perforated metal, and bent in similar form as the rod D, and have their upper ends attached in pinions G G. Holes *f* are made in the middle of the lower part of each dasher, through which one end of the supporting-rod D passes until the bearings of the dashers are formed at *d d*. The pinions G G have bearings on the upper part of the rod D, and are operated by a gear-wheel, H. The gear-wheel has bearings on an arm of the handle E, and operates directly upon one of the pinion-wheels which operates upon the other. Thus geared, the dashers turn in opposite directions, and the circular part of each dasher being constructed so as nearly to fill the diameter of the vessel in which it is to be used, and to intersect each others tracks without interference, I make the parallel parts of each dasher close together, so that the air is sucked down between them by the rapid rotary mo-

tion of the circular part and thus the entire cream is aerated. This process of distributing air through the cream is assisted by the perforations *d'*, by which I have obtained butter in two minutes, and herein is one of the great advantages of my invention. In the handle F, I make holes *e e e* for attaching it to the support C, the rod D being attached to the handle. When the handle is raised, one-half of the cover and everything in the vessel may be removed, thus leaving it easy to wash the vessel, not having holes or cleats in the bottom to make it difficult to clean as heretofore in rotary dash-churns, and herein is another advantage of my invention. The circular part of my dashers I place beneath the cream by means of the thumb-screws on the support C, which enter the holes *e e*, thus permitting the attached dashers to be raised or lowered, as desired. This permits the parallel parts of the dashers to enter the surface and thus prevent all splashing and throwing of the cream while churning, and herein is another great advantage of the parallel and adjustable construction of my invention.

Having thus described the use, construction, and operation of my invention, I am aware that it is not new to provide a churn with rotary dashers, or to have such dashers perforated, or to have the lower parts made rounding and propelled by gear-wheels. I do not, therefore, claim such construction broadly; but

What I claim as new, and desire to secure by Letters Patent, is—

The combination of a vessel, A, severable cover B, slotted attachment A', support C, secured to one side of the said cover, adjustable handle E, rod D, drive-wheel H, pinions G G, and perforated rotary dashers F F, having circular bottoms and rods placed parallel and close together the better to agitate and force air into the cream, substantially as shown and described, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL J. SULLIVAN.

Witnesses:
JOSEPH S. MCBRIDE,
J. P. FROW.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 50.

5061

Die

trocknenden Oele

ihre

Eigenschaften, Zusammensetzung und Veränderungen

sowie

Fabrikation der Firnisse aus denselben zu Anstrichen und für Buchdrucker, genaue Darstellung der Fabrikation aller Anstrich-, Buchdruck-, Stein- und Kupferdruckfarben.

Ein Handbuch

für

Lack-, Firniß- und Farbenfabrikanten, Kaufleute, Anstreicher, Lackirer, Maler u. s. w.,

nach dem

neuesten Stande dieser Industriezweige, unter Benutzung der hervorragendsten Literatur und nach eigenen vieljährigen Erfahrungen dargestellt

von

Louis Edgar Andés,

Lack- und Firniß-Fabrikant in Wien

Mit 49 in den Text eingedruckten Holzstichen

Braunschweig,

Druck und Verlag von Friedrich Vieweg und Sohn

1882.

5062

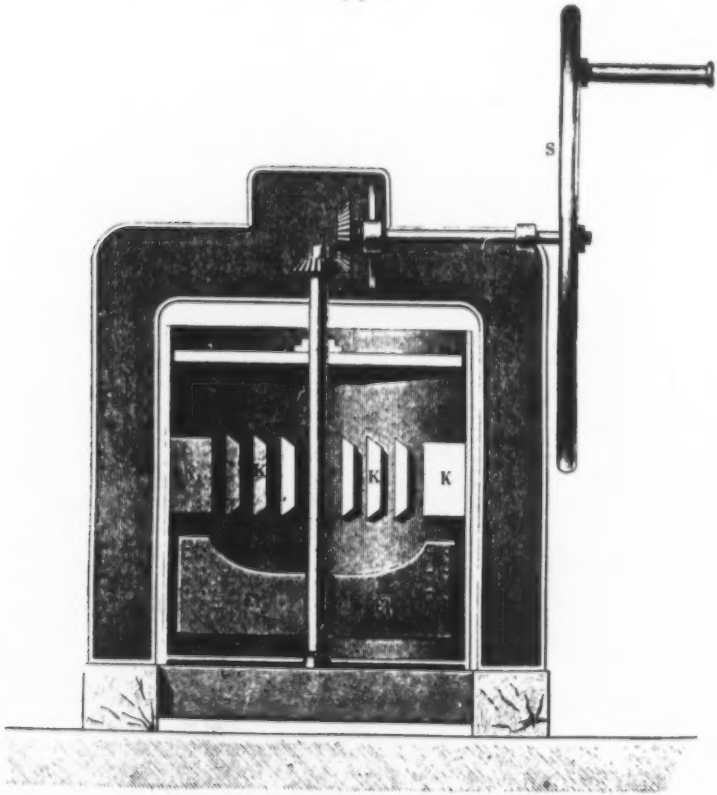
ſteht auf dem oberen Boden und enthält zwei durchbohrte Böden, durch welche es in drei Abtheilungen zerlegt iſt. Die untere derſelben ſteht durch ein kurzes knieförmig gebogenes Rohr mit dem Oelbehälter in Verbindung, während die mittlere mit gröblich gepulverter Kohle, Baumwolle, Filz u. dergl. gefüllt wird. Die obere Abtheilung dient zum Anſammeln des filtrirten Oeles und iſt mit einem Hahne zum Abziehen deſſelben verſehen. Fig. 5 zeigt die Einrichtung. Sind die Ciſterne mit Waſſer und der Behälter mit Oel gefüllt, ſo öffnet man die Röhre; das Waſſer tritt nun in den Oelbehälter und nimmt in demſelben in Folge ſeiner Schwere den unteren Raum ein, während das Oel durch die eine Röhre in das Filter ſteigt und durch den hydroſtatiſchen Druck der in der anderen Röhre enthaltenen Waſſerſäule durch das Filter getrieben wird. Wenn ſich nach fortgeſetzter Arbeit in dem unteren Raum des Filters ein ſchleimiger Abſatz aus dem Oele ſammelt, ſo läßt man dieſen durch den Hahn ab. Man hat es auf dieſe Weiſe in ſeiner Gewalt, das klare Oel ſchnell von dem Bodenſatze zu trennen.

Ein anderes Verfahren iſt folgendes: Man bringt das zu reinigende Oel in eine, einem Drehbutterfaſſe gleichende Tonne, in deren Innerem ſich eine mit Flügeln verſehene Welle befindet, die durch eine Kurbel in Bewegung gebracht wird. Zu dem Oele gießt man das zweifache Volum reines Flußwaſſer, in dem etwas Kochſalz aufgelöſt wurde. Nachdem die Tonne geſchloſſen worden, bringt man die Miſchung eine volle Stunde lang durch Umdrehen der Welle in Bewegung. Je ſchneller dieſes Umdrehen geſchieht, um ſo mehr wird für die Reinigung des Oeles geſorgt. Man öffnet nun die Tonne und gießt das Ganze in einen Kübel, an deſſen Seite ein Hahn in ſolcher Höhe angebracht iſt, daß das nach einiger Ruhe über das Waſſer tretende Oel rein durch denſelben abgelaſſen werden kann. Nachdem man das Oel nun 24 Stunden der Ruhe überlaſſen hat, wird das Oel abgelaſſen und wieder in die Tonne gebracht, um mit ebenſoviel Waſſer als vorher abermals durcheinander geſchlagen zu werden. In dem, in dem Kübel zurückgebliebenen Waſſer findet man einen bedeutenden Bodenſatz, der durch den von dem Oele getrennten ſogenannten Schleim gebildet worden iſt. In neuerer Zeit ſucht man Oele zum Zwecke der Firnißfabrikation auch auf mechaniſchem Wege mittelſt Maſchinen zu reinigen; bei dieſen wird das Oel in heftige Bewegung verſetzt und mit der Luft in innige Berührung gebracht, damit ſich die Unreinigkeiten leichter ausſcheiden und dem Oele ſchon vor dem Kochen Sauerſtoff zugeführt werde.

Die von der Actiengeſellſchaft für Maſchinenbau und Eiſeninduſtrie zu Varel an der Jahde im Großherzogthume Oldenburg neuerdings gebaute Kataractmaſchine ſcheint dazu berufen, alle anderen Maſchinen, welche man bis jetzt zur raſcheren Reinigung des Oeles verwendete, zu verdrängen, und verdient dieſelbe Eingang in alle Firniß- und Lackfabriken. Fig. 6 (a. f. S.) zeigt einen Vertikalſchnitt durch die Maſchine. Das zu reinigende Oel wird bis zu einer Marke in das eiſerne cylindriſche Faß gegeben. Beim Drehen am Schwungrade *S* wird der Flügel *Fl* in raſche Umdrehung verſetzt; das Oel ſteigt in Folge der Wirkung der Centrifugalkraft an den Wänden des Faſſes in die Höhe, wird durch die Klappen *K K* und einem darüber liegenden Ring abgelenkt und ſtürzt in der Mitte zuſammen; das Oel macht alſo einen Kreislauf, und während dieſes Kreislaufes findet ein ſo intenſives Miſchen und eine ſo heftige

Bewegung und dabei eine so innige Berührung mit der atmosphärischen Luft statt, wie es durch keine andere Maschine und auf keine andere Weise erreicht werden kann. Deshalb eignet sich die Maschine auch so sehr gut zur Reinigung des Oeles

Fig. 6.



Kataractmaschine zur Oelreinigung.

und kann außerdem auch noch zum Mischen von Firniß oder Lack mit Farben benutzt werden.

Die genannte Actiengesellschaft baut die Kataractmaschinen von 20 bis 400 Liter Inhalt, und kostet eine solche von 100 bis 125 Liter Inhalt mit eisernem Faß und rotirendem Deckel sammt großem Schwungrade für Handbetrieb 250 Mark D. Rw. ab Barel. Größere Maschinen werden nur für Kraftbetrieb mit Riemenscheiben geliefert.

Ein großer Theil des im Handel vorkommenden Leinöles wird mit Schwefelsäure gereinigt und kennt man verschiedene Verfahrungsweisen.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

64 Defendant's Exhibit No. 51.

Dept Ex 51
adm

(Title Page, "AGRICOLA DE RE METALLICA" (Hoover Translation) is as follows:)

GEORGIUS AGRICOLA

DE RE METALLICA

Translated from the First Latin Edition of 1556,
with
Biographical Introduction, Annotations and Appendices upon the Development of Mining Methods, Metallurgical Processes, Geology, Mineralogy & Mining Law from the earliest times to the 16th Century.

by

HERBERT CLARK HOOVER

A.B.Stanford University, Member American Institute of Mining Engineers, Mining and Metallurgical Society of America, Societe des Ingenieurs Civils de France, American Institute of Civil Engineers, Fellow Royal Geographical Society, etc. etc.

and

LOU HENRY HOOVER

A.B.Stanford University, Member American Association for the Advancement of Science, The National Geographical Society, Royal Scottish Geographical Society, etc. etc.

Published for the Translators by

THE MINING MAGAZINE

Salisbury House, London E.C.

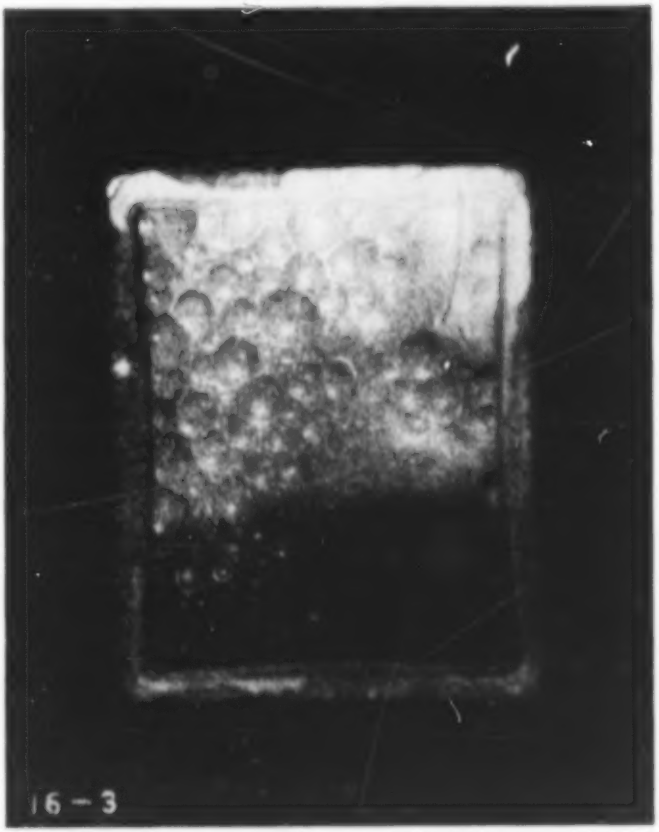
1912.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

A—Water-wheel. B—Axle. C—Stamp. D—Hopper in the upper millstone. E—Opening passing through the centre. F—Lower millstone. G—Its round depression. H—Its outlet. I—Iron axle. K—Its crosspiece. L—Beam. M—Drum of rundles on the iron axle. N—Toothed drum of main axle. O—Tubs. P—The small planks. Q—Small upright axles. R—Enlarged part of one. S—Their paddles. T—Their drums which are made of rundles. V—Small horizontal axle set into the end of the main axle. X—Its toothed drums. Y—Three sluices. Z—Their small axles. AA—Spokes. BB—Paddles.

5008

Defendant's Exhibit No. 52.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

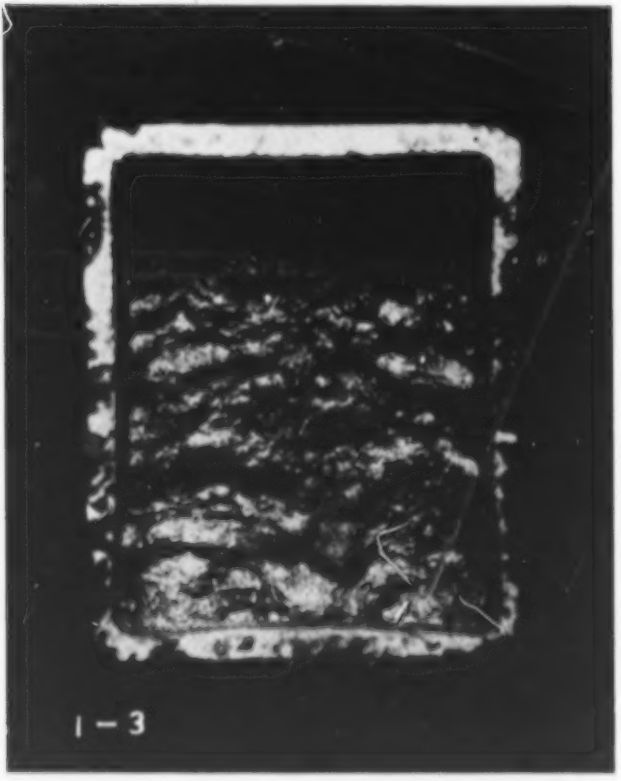
5000

Defendant's Exhibit No. 53.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5070

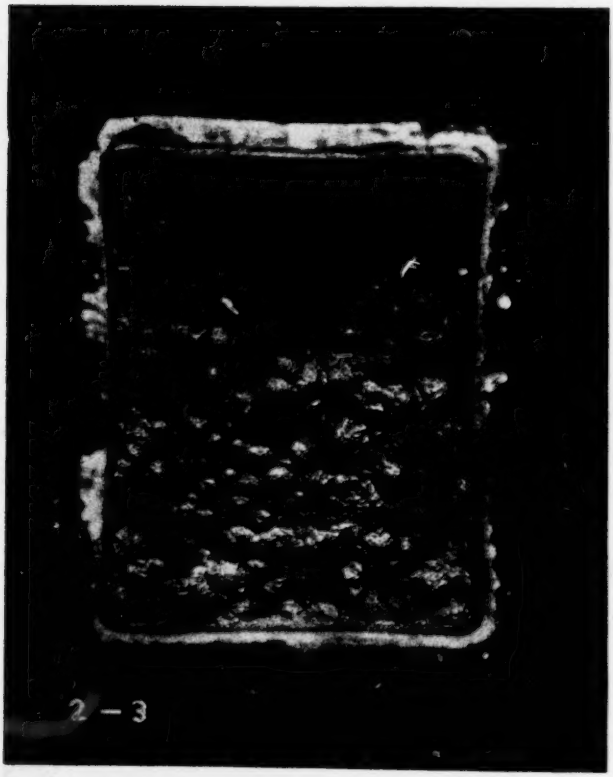
Defendant's Exhibit No. 54.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5071

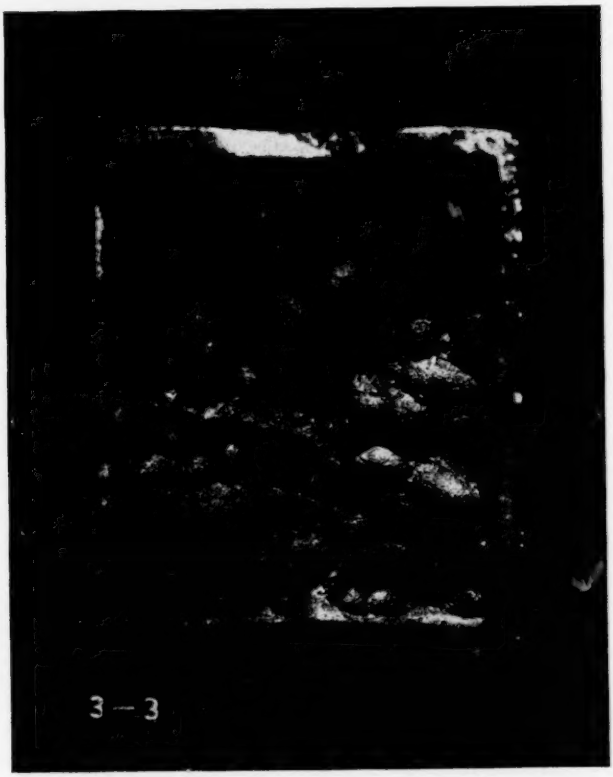
Defendant's Exhibit No. 55.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5072

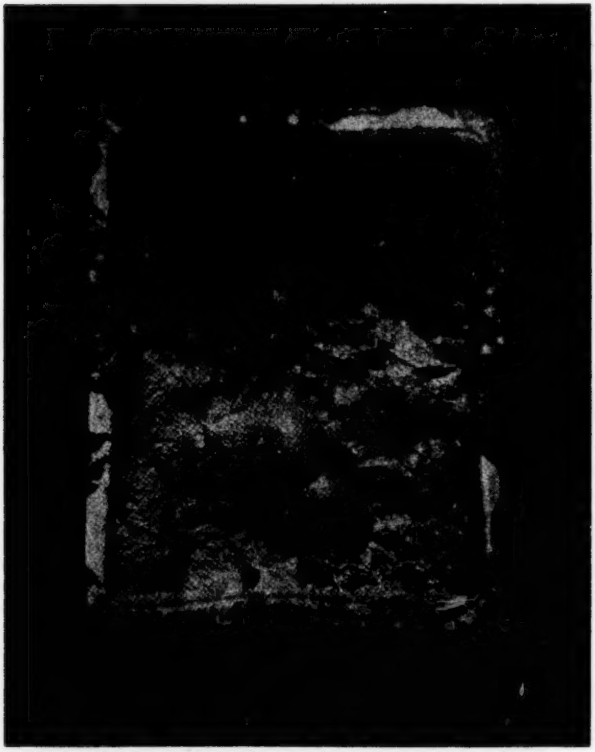
Defendant's Exhibit No. 56.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5073

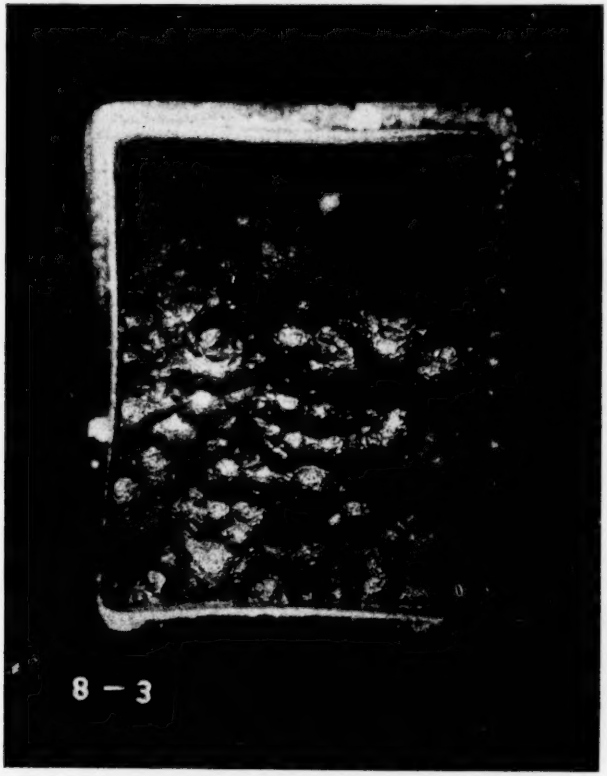
Defendant's Exhibit No. 57.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5074

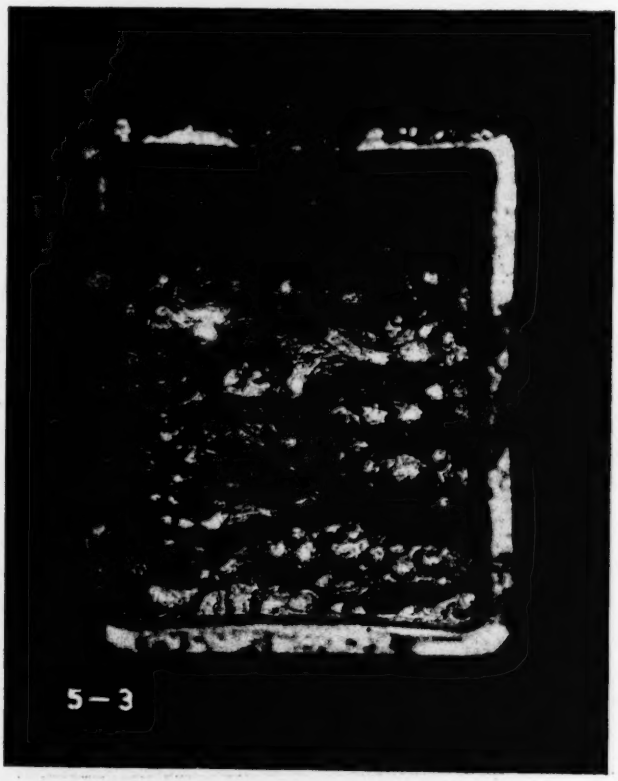
Defendant's Exhibit No. 58.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5075

Defendant's Exhibit No. 59.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5076

Defendant's Exhibit No. 60.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

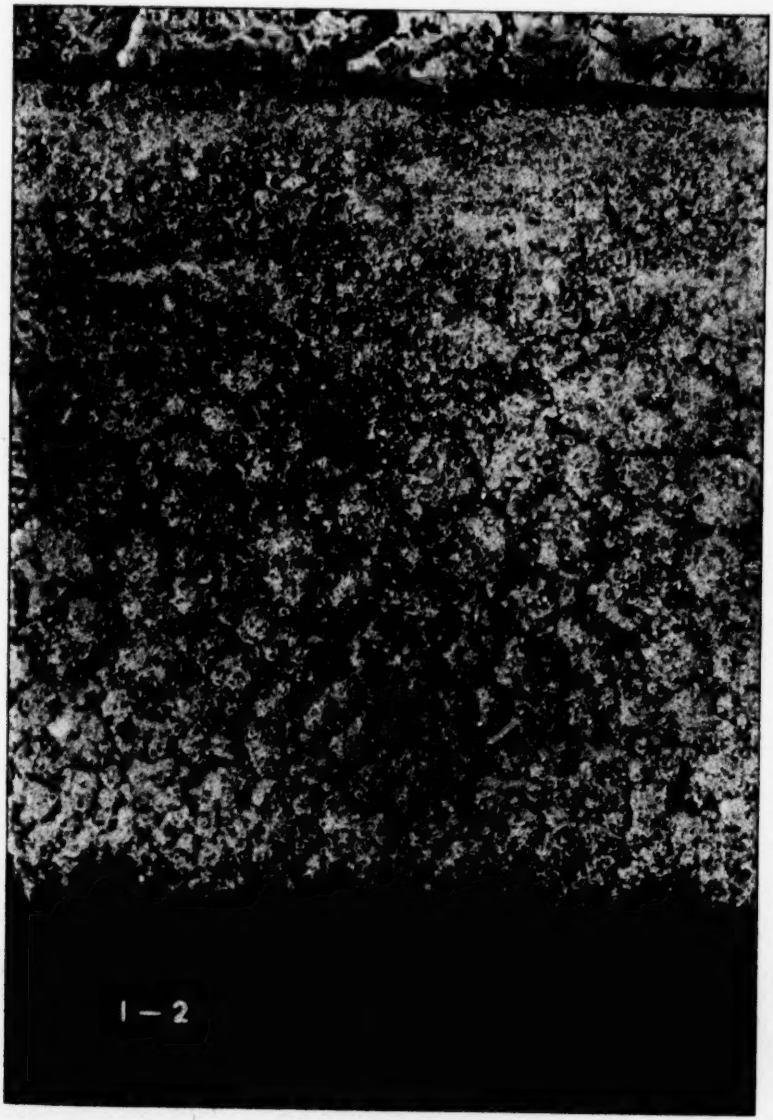
5077

Defendant's Exhibit No. 61.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5078

Defendant's Exhibit 62.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5079

Defendant's Exhibit No. 63.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5080

Defendant's Exhibit No. 64.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

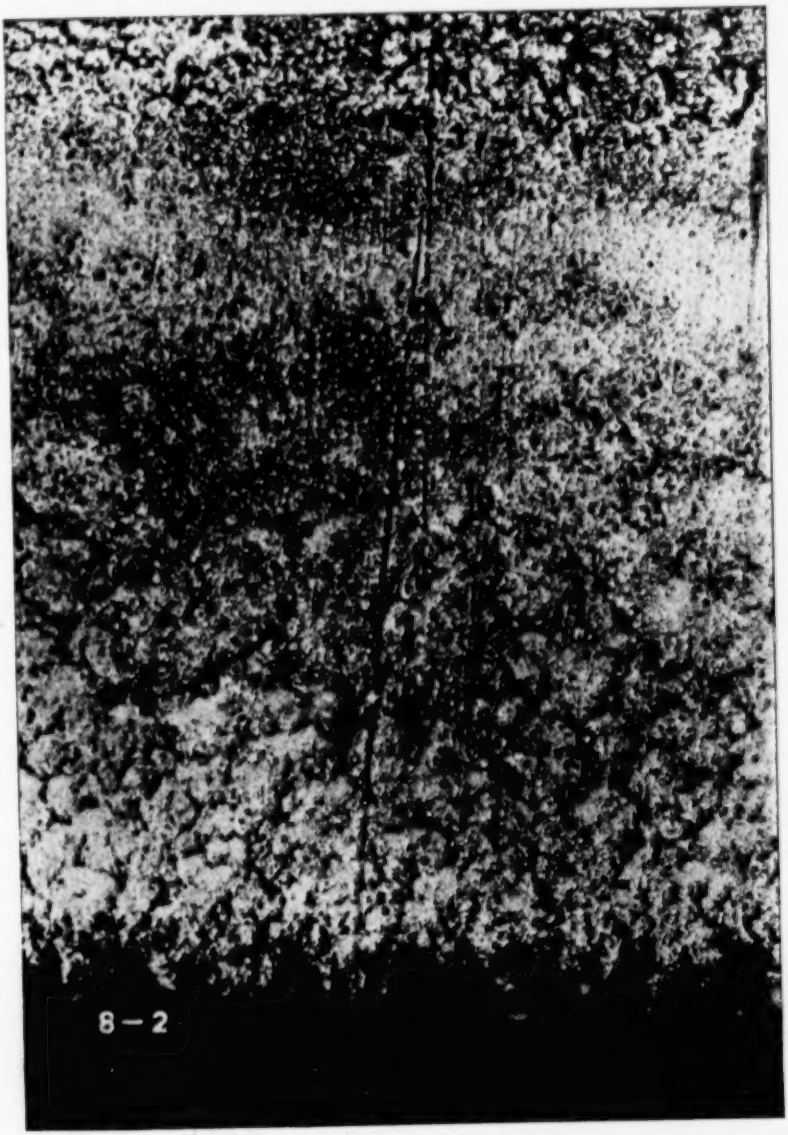
5081

Defendant's Exhibit No. 65.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5082

Defendant's Exhibit No. 66.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5083

Defendant's Exhibit No. 67.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

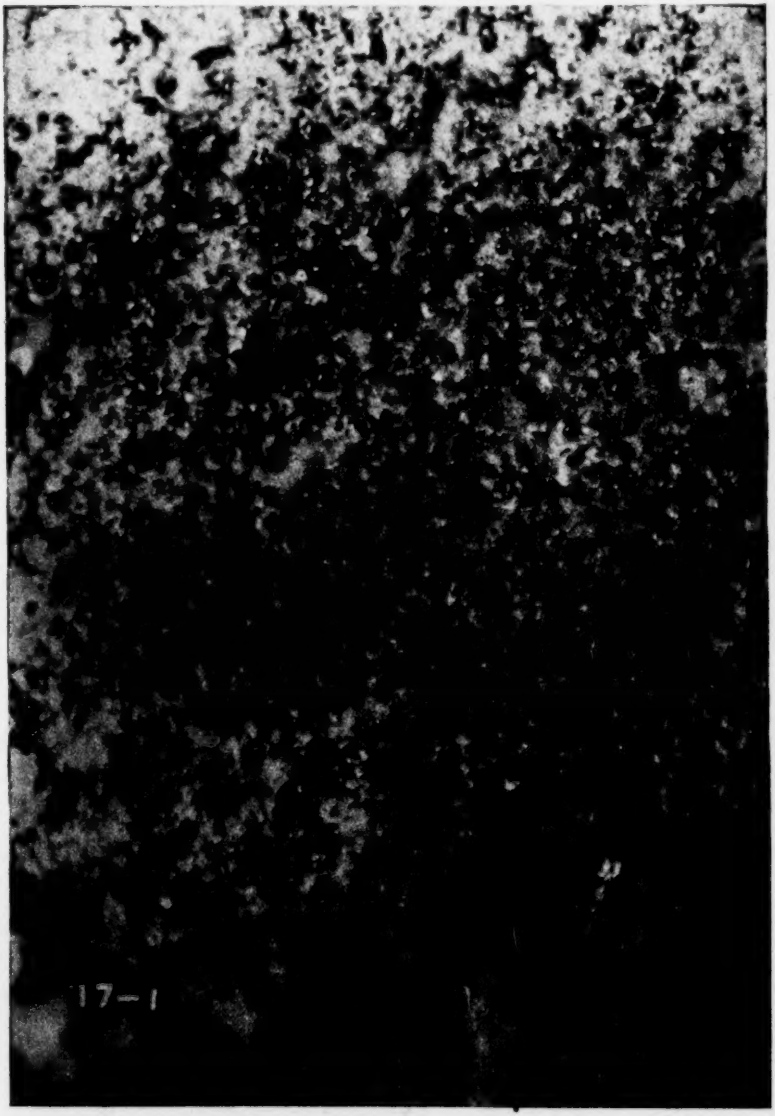
5084

Defendant's Exhibit No. 68.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5085

Defendant's Exhibit No. 69.



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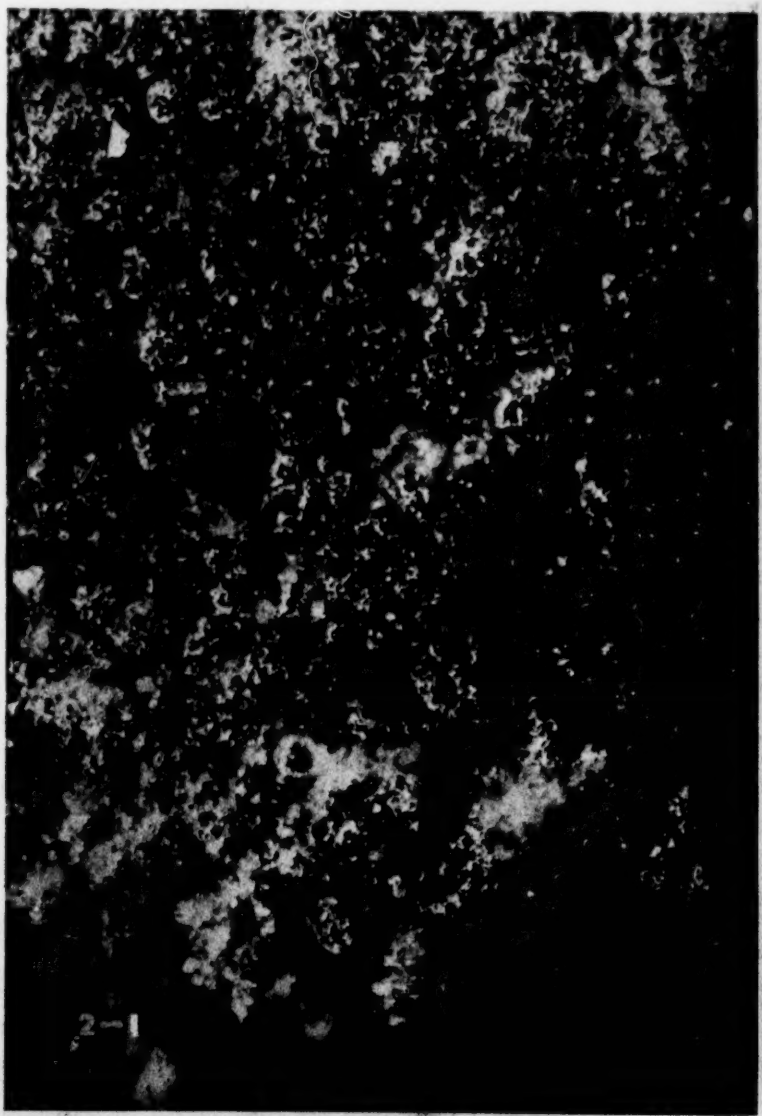
5086

Defendant's Exhibit No. 70.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5087

Defendant's Exhibit No. 71.



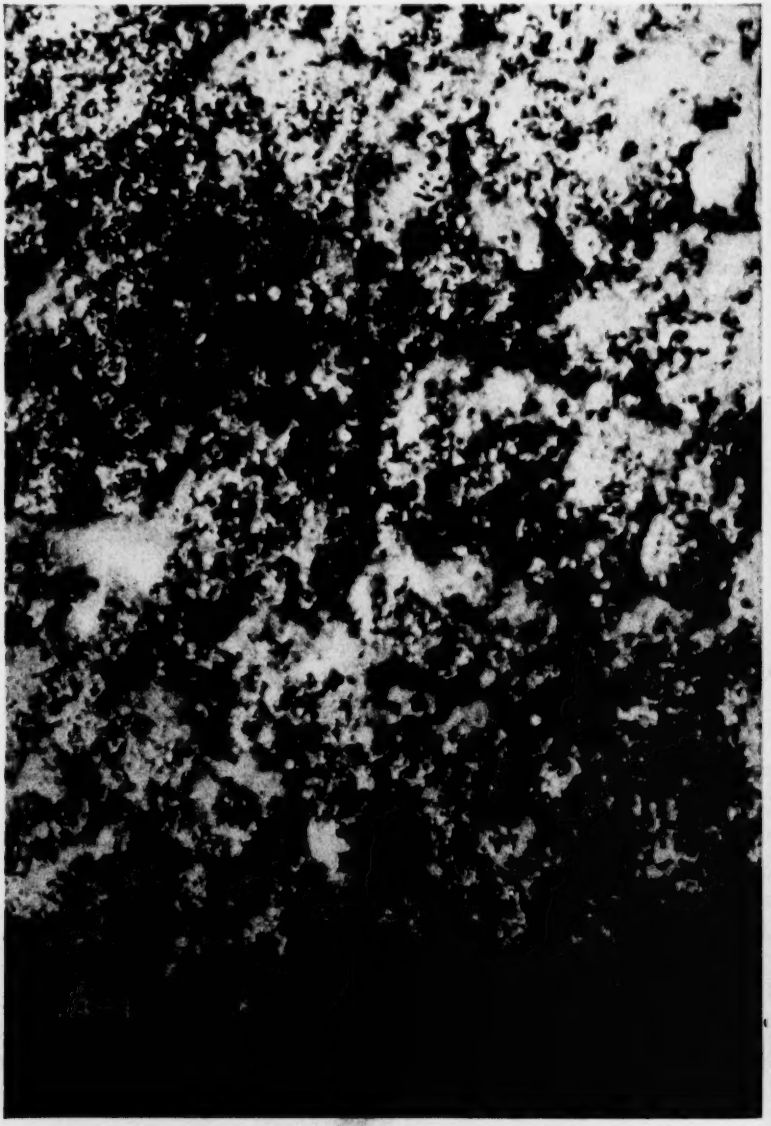
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5088

Defendant's Exhibit No. 72.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 73.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

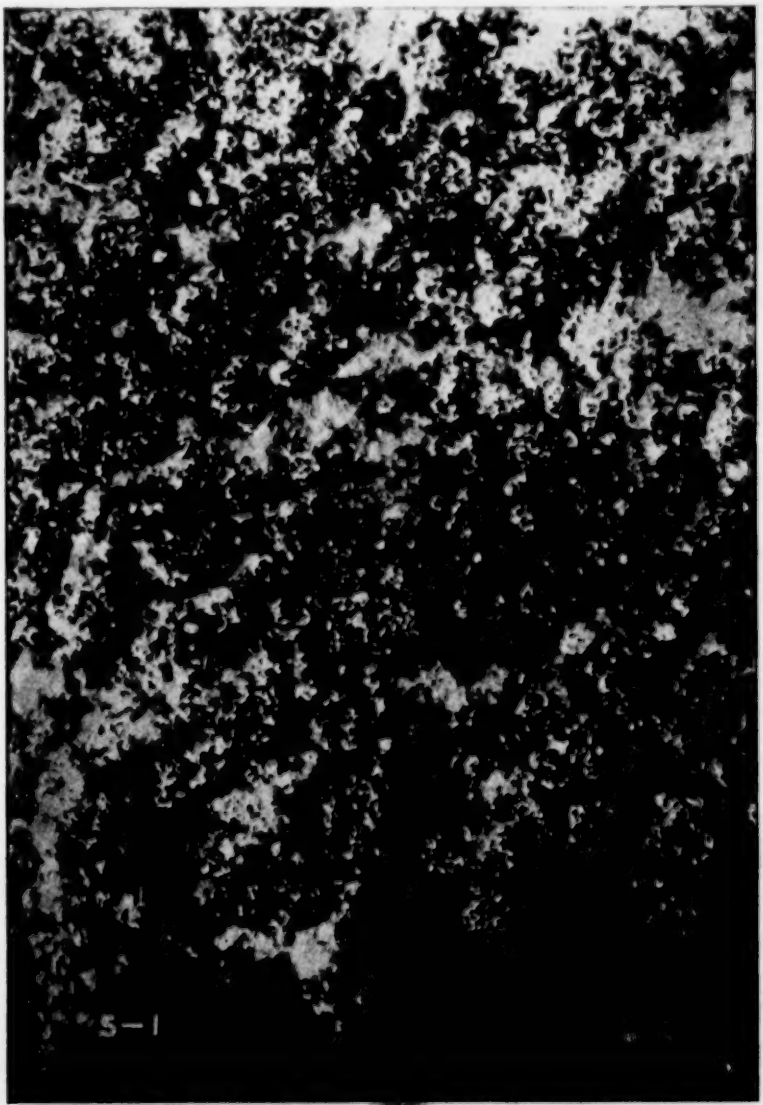
5090

Defendant's Exhibit No. 74.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5091

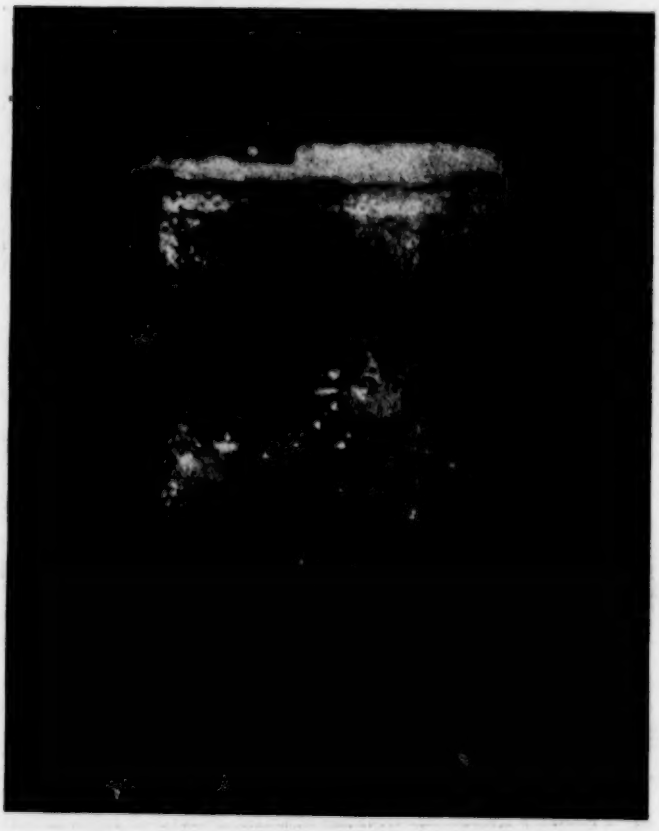
Defendant's Exhibit No. 75.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5002

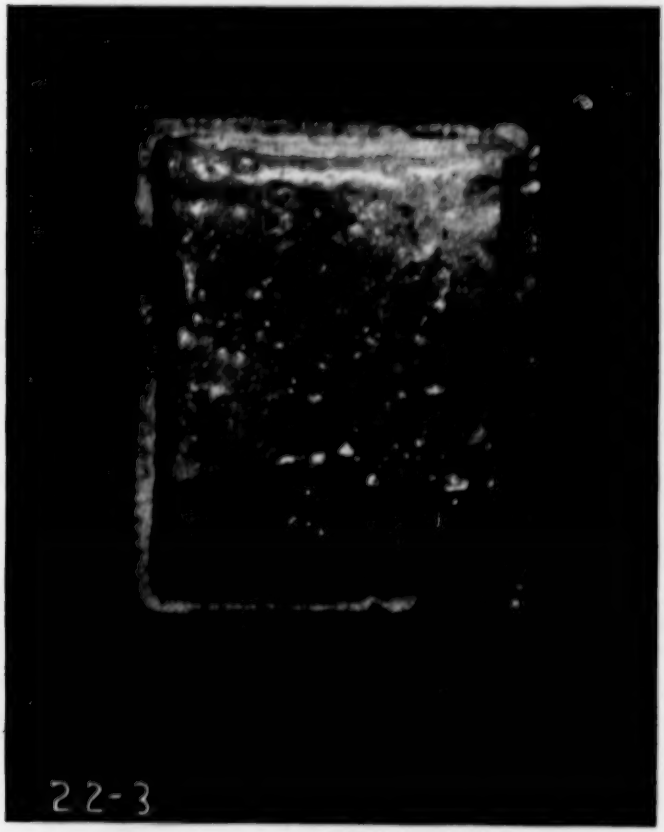
Defendant's Exhibit No. 76.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5093

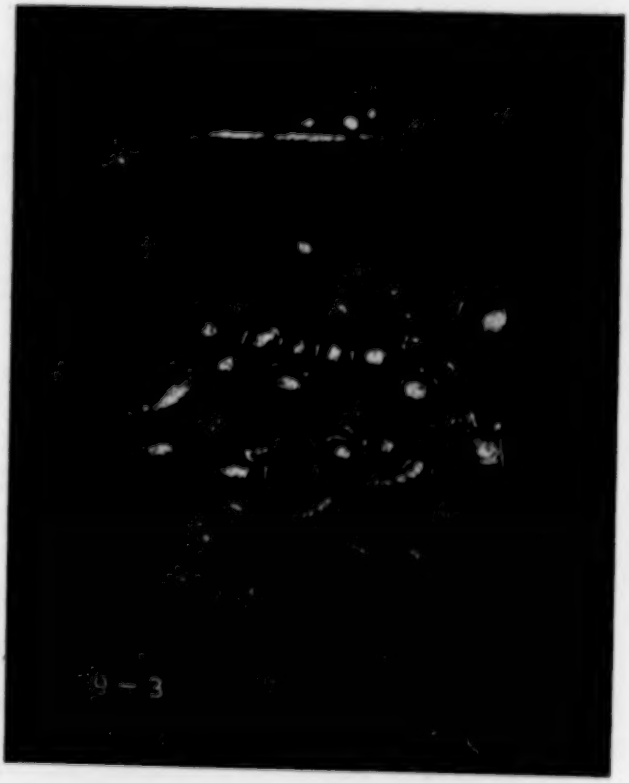
Defendant's Exhibit No. 77.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5094

Defendant's Exhibit No. 78.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

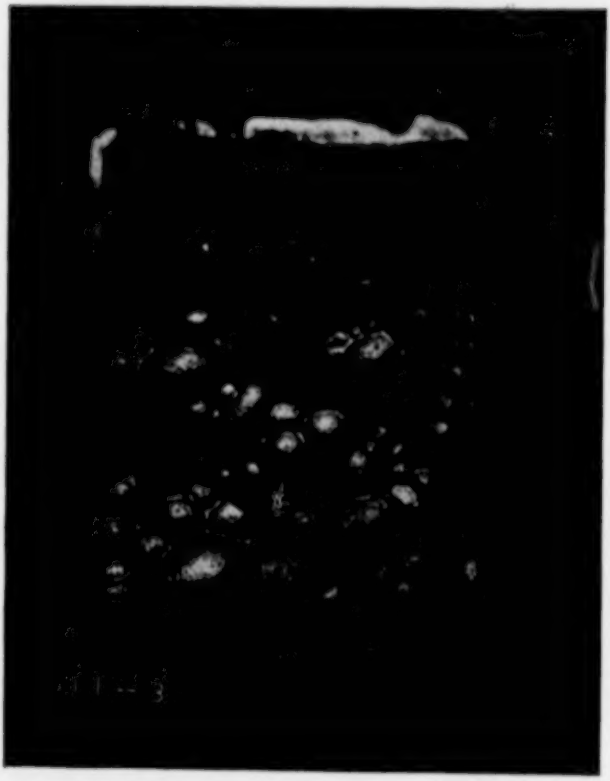
5096

Defendant's Exhibit No. 79.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5696

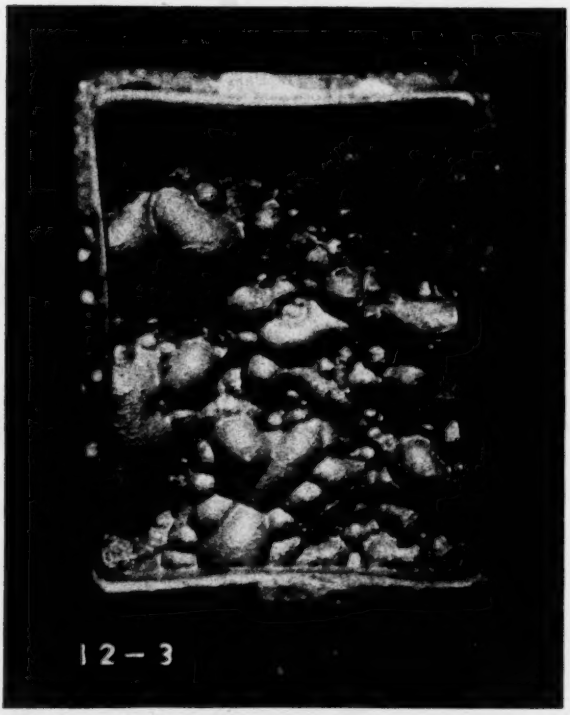
Defendant's Exhibit No. 80.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5097

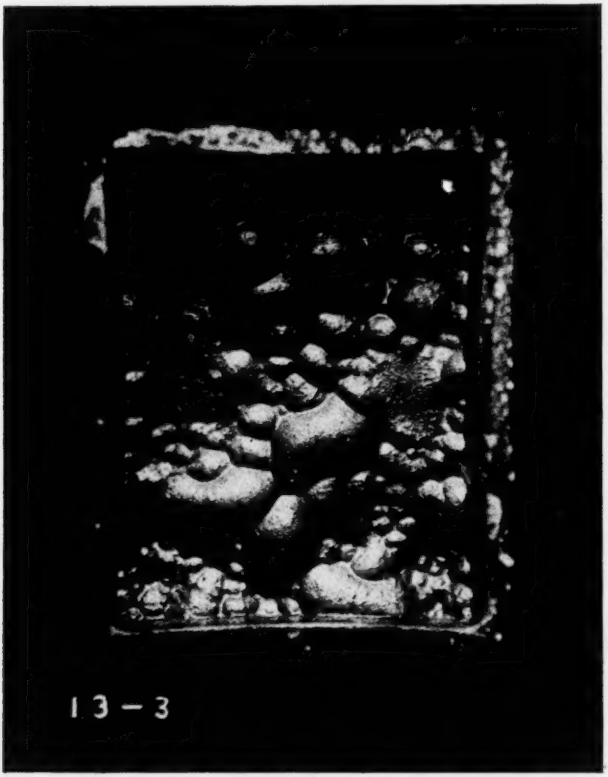
Defendant's Exhibit No. 81.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5098

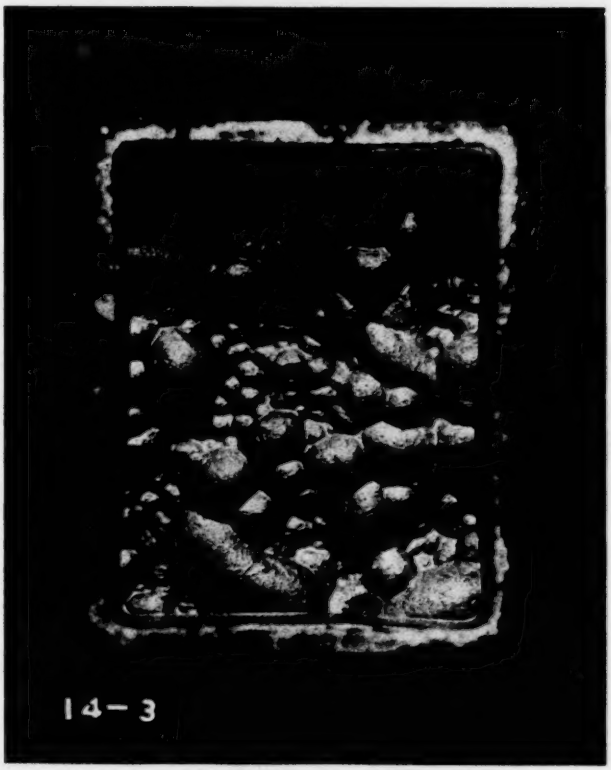
Defendant's Exhibit No. 82.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5099

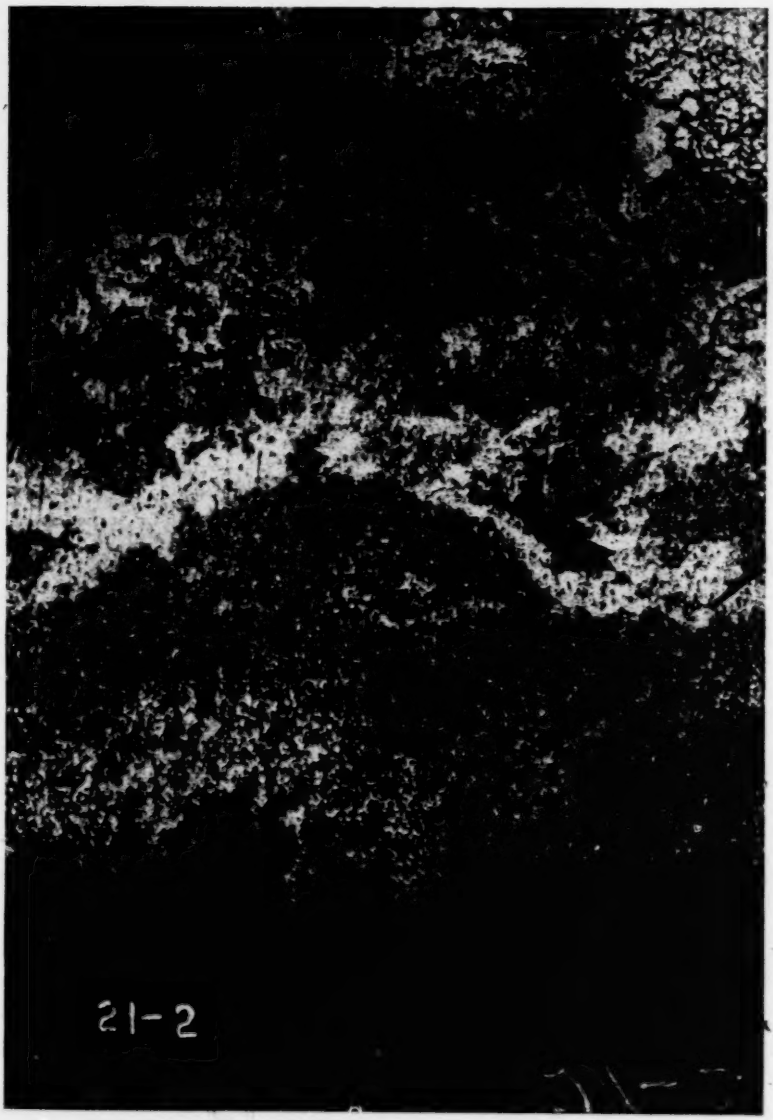
Defendant's Exhibit No. 83.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5100

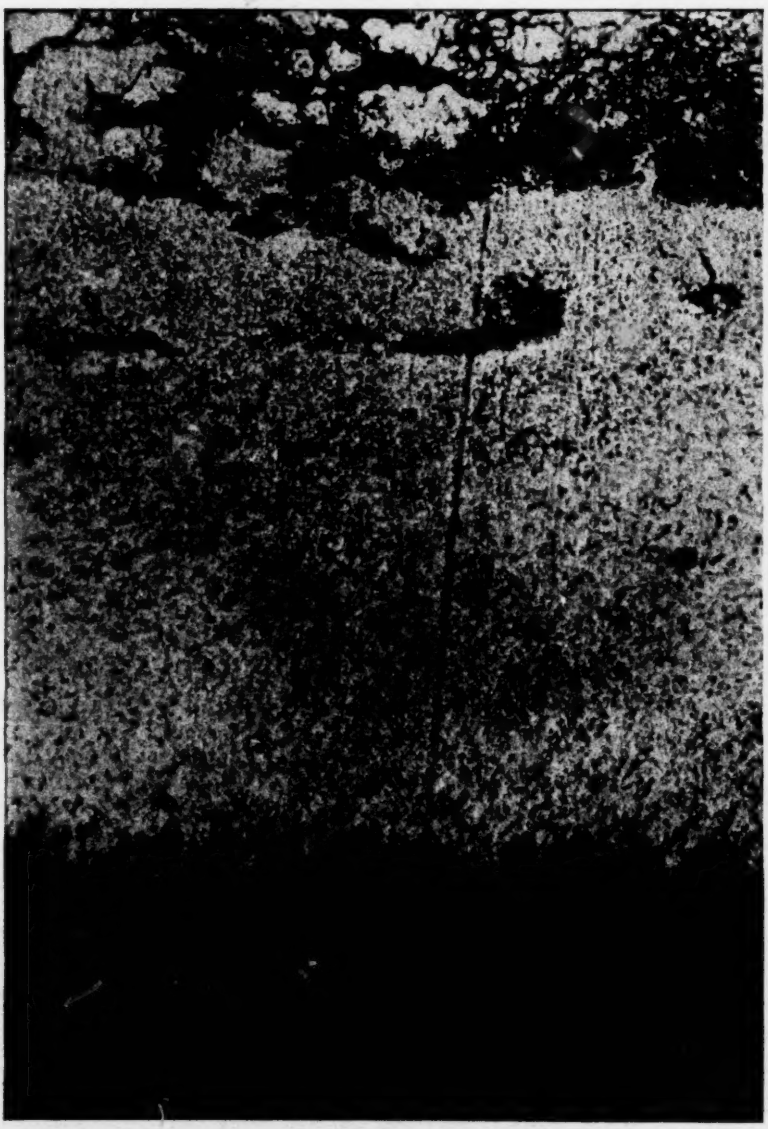
Defendant's Exhibit No. 84.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5101

Defendant's Exhibit No. 85.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5102

Defendant's Exhibit No. 86.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

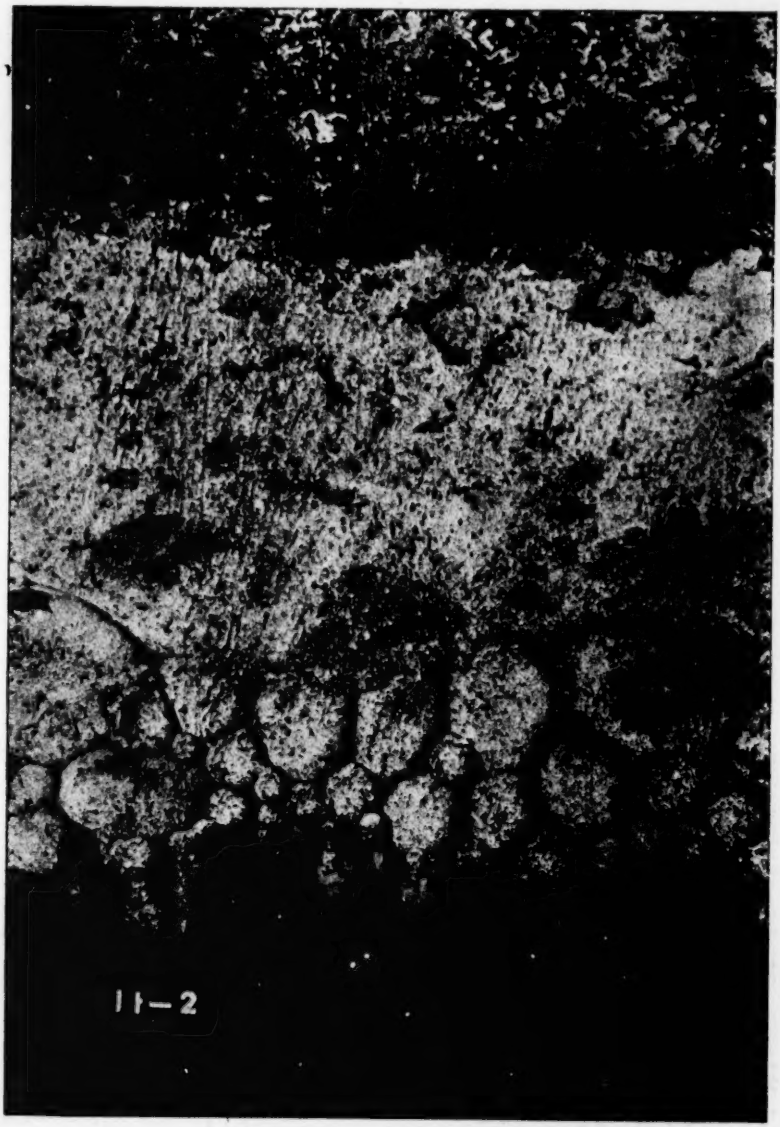
5103

Defendant's Exhibit No. 87.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5104

Defendant's Exhibit No. 88.



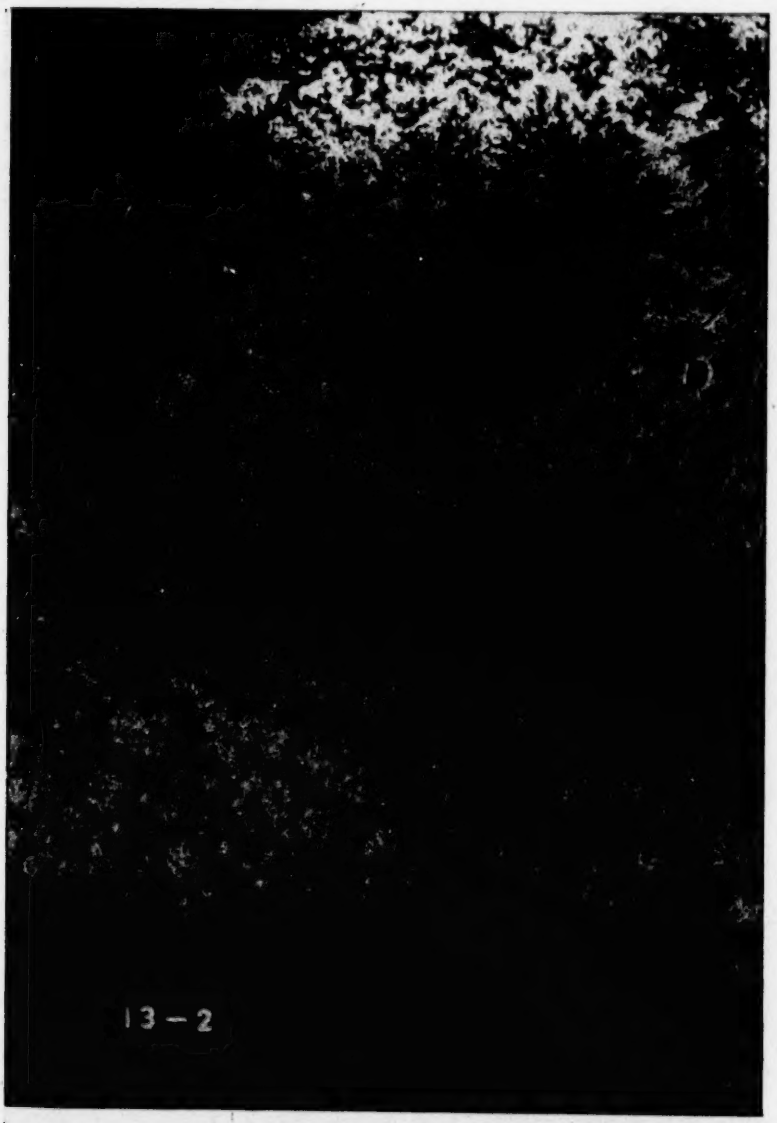
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 89.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5106

Defendant's Exhibit No. 90.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 91.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5108

Defendant's Exhibit No. 92.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

176—Rec.

Defendant's Exhibit No. 93.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5110

Defendant's Exhibit No. 94.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 95.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5112

Defendant's Exhibit No. 96.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5113

Defendant's Exhibit No. 97.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5114

Defendant's Exhibit No. 98.

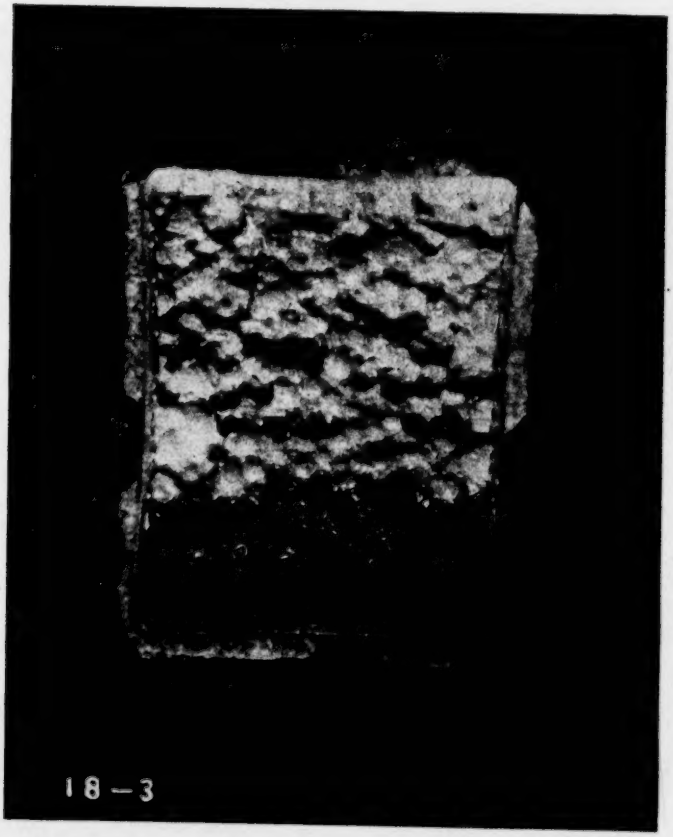
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 99.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

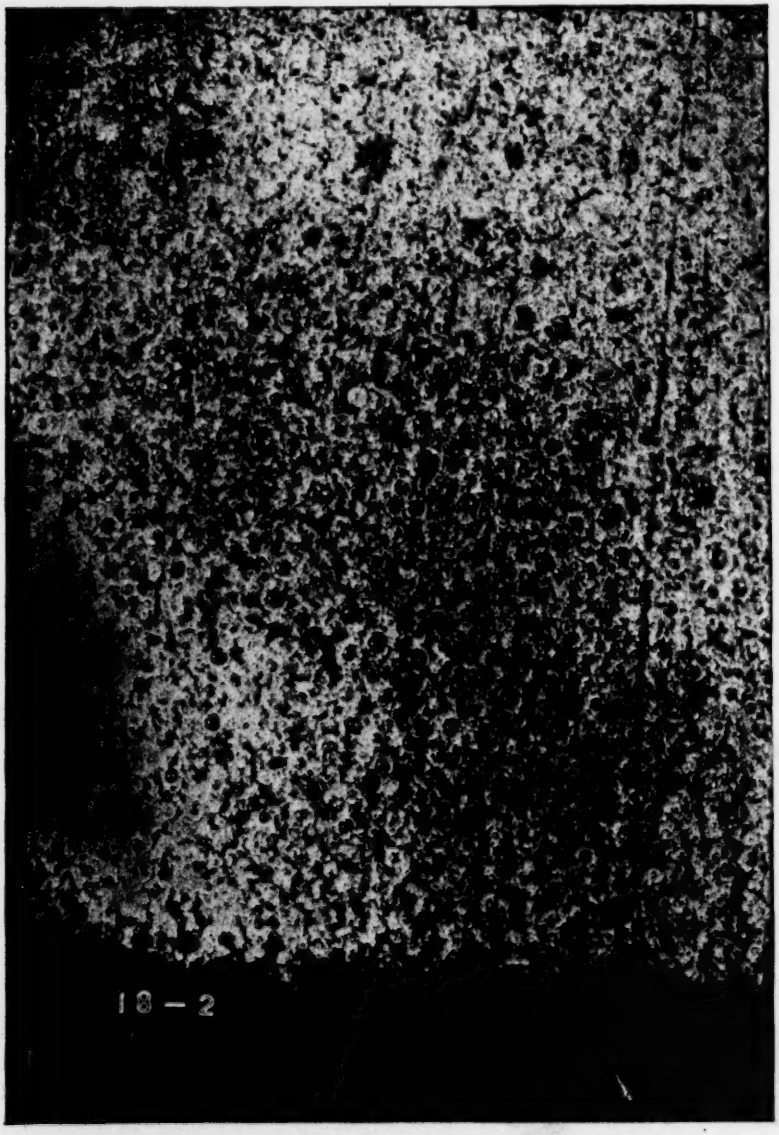
5116

Defendant's Exhibit No. 100.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

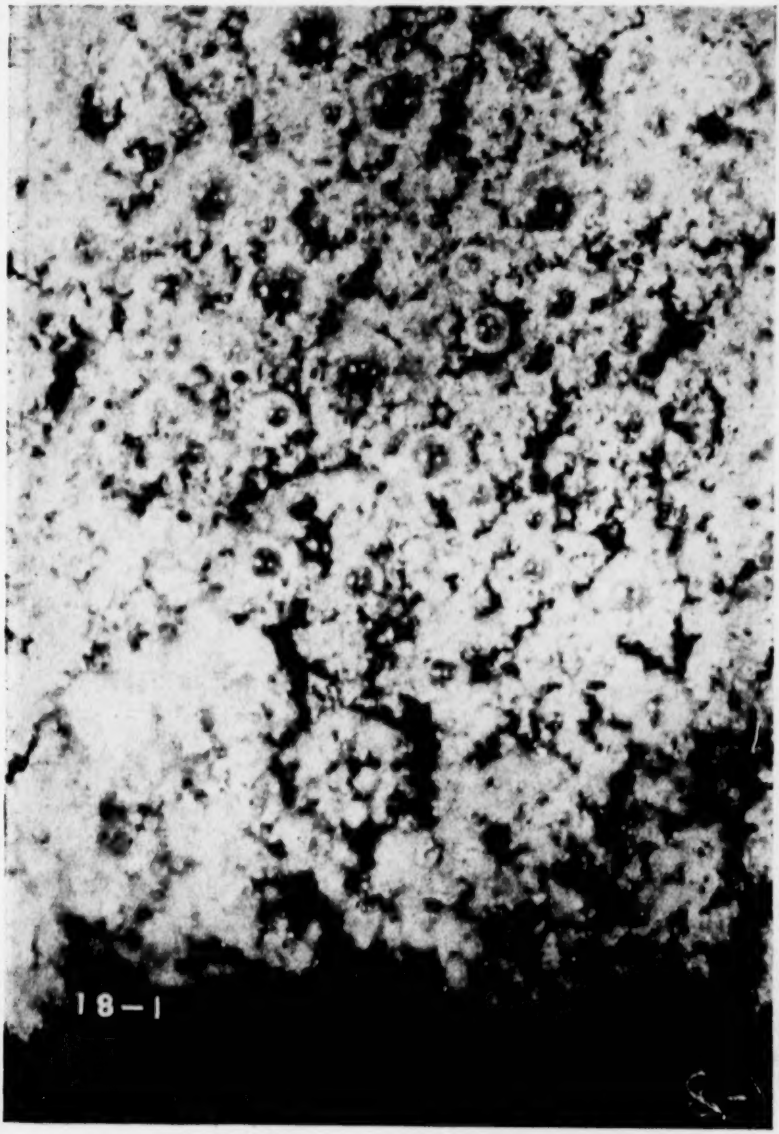
Defendant's Exhibit No. 101.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5118

Defendant's Exhibit No. 102.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5119

Defendant's Exhibit No. 103.

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5120

Defendant's Exhibit No. 104.

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5121

Defendant's Exhibit No. 105.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5122

Defendant's Exhibit No. 106.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

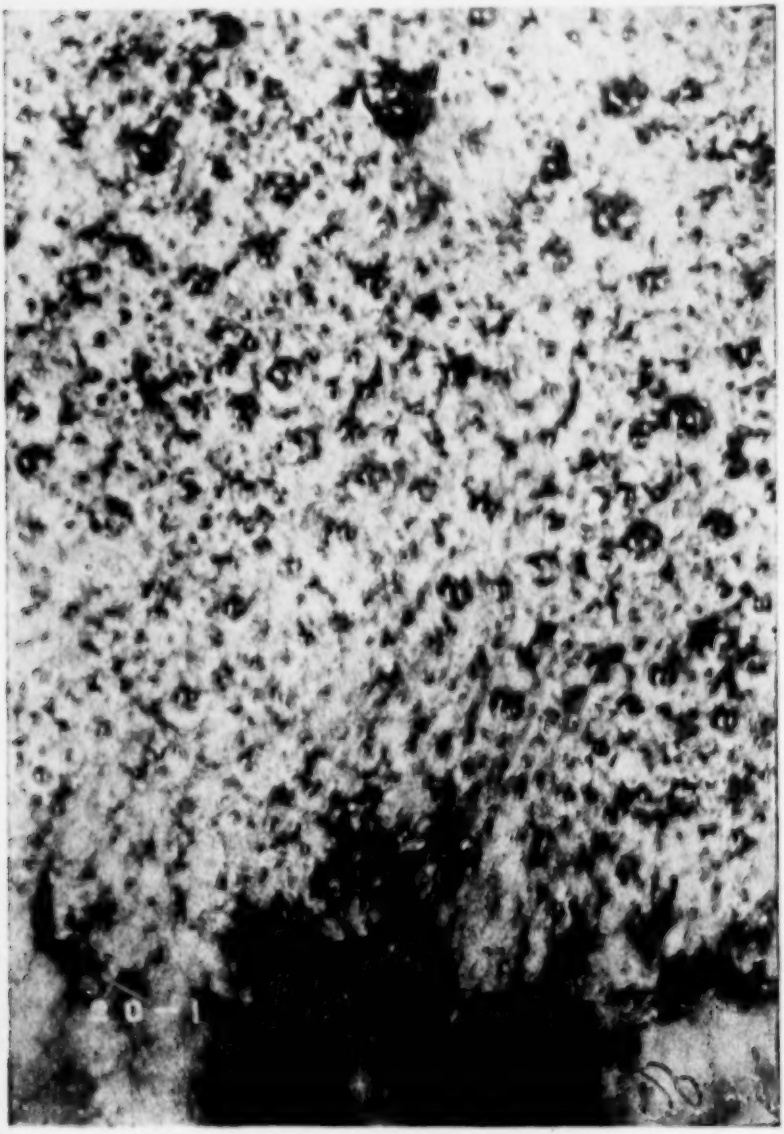
5123

Defendant's Exhibit No. 107.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5124

Defendant's Exhibit No. 108.

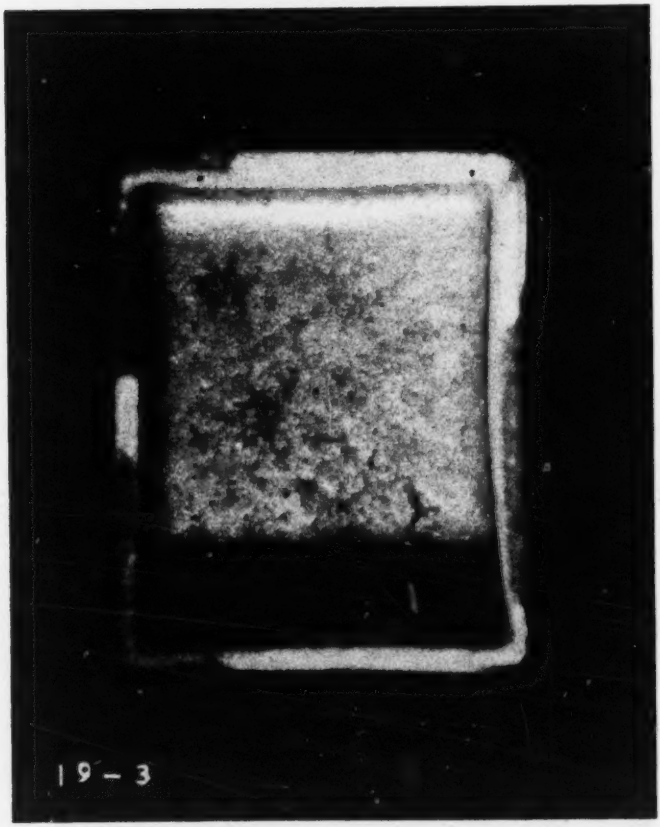


Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

177—Rec.

5125

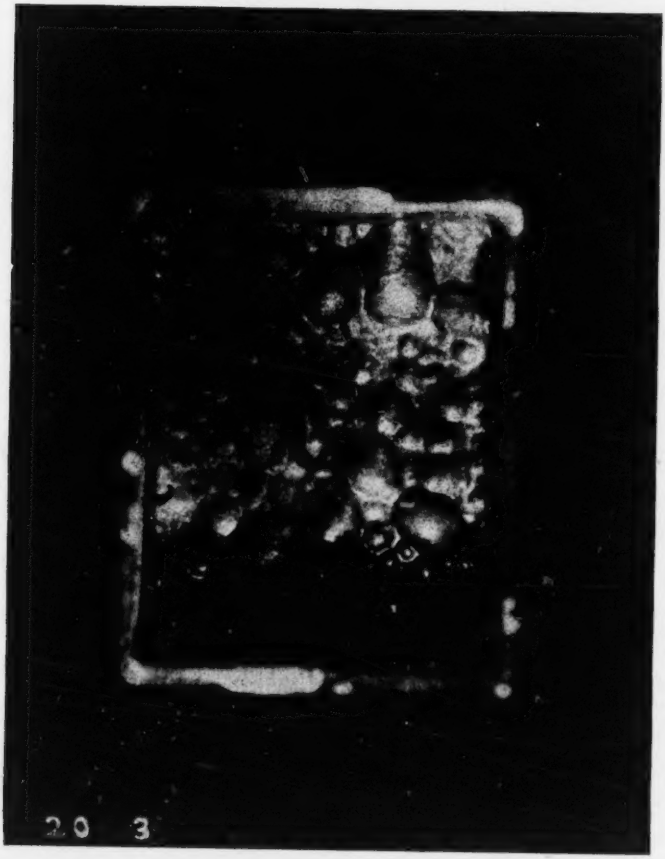
Defendant's Exhibit No. 109.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5126

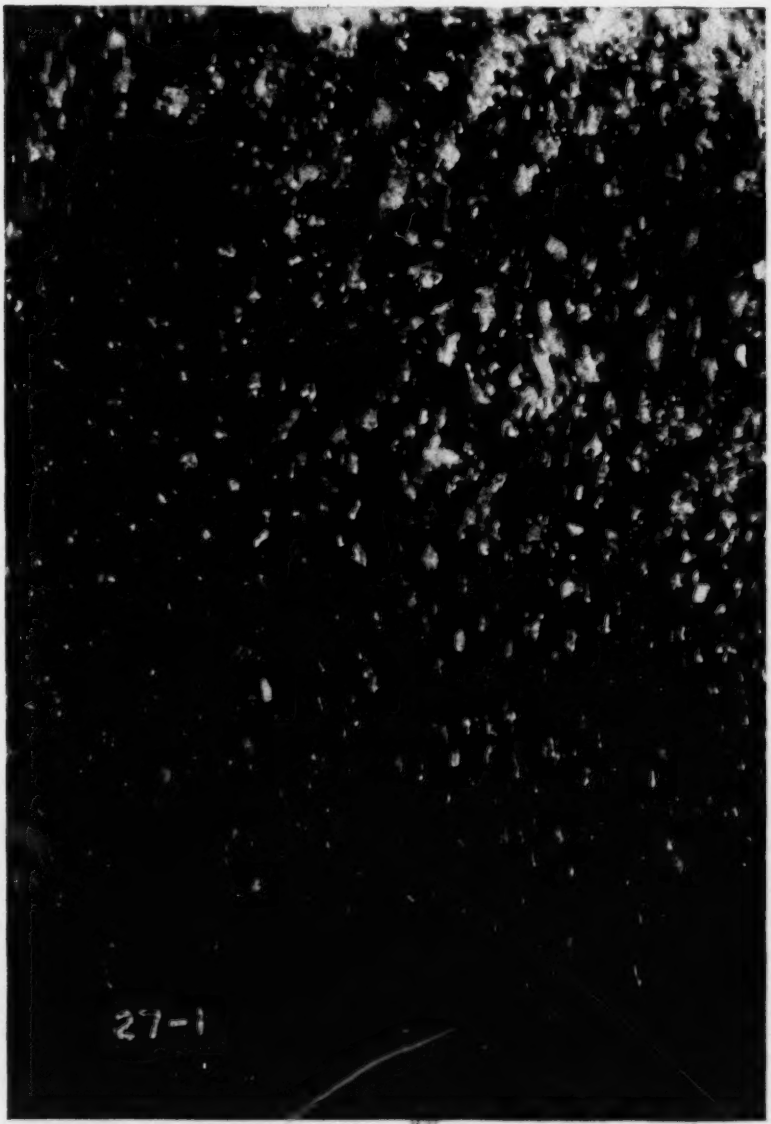
Defendant's Exhibit No. 110.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5127

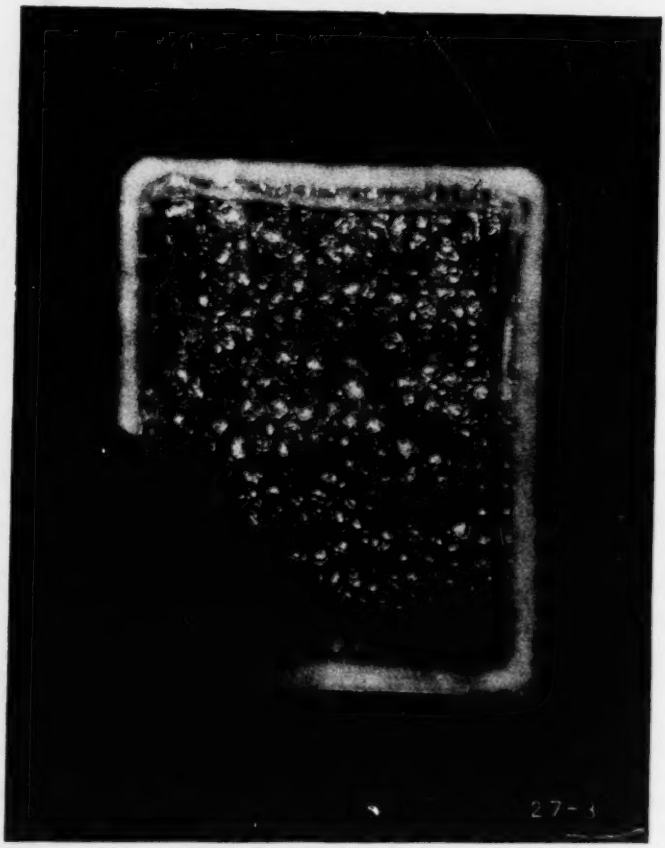
Defendant's Exhibit No. 111.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5128

Defendant's Exhibit No. 112.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

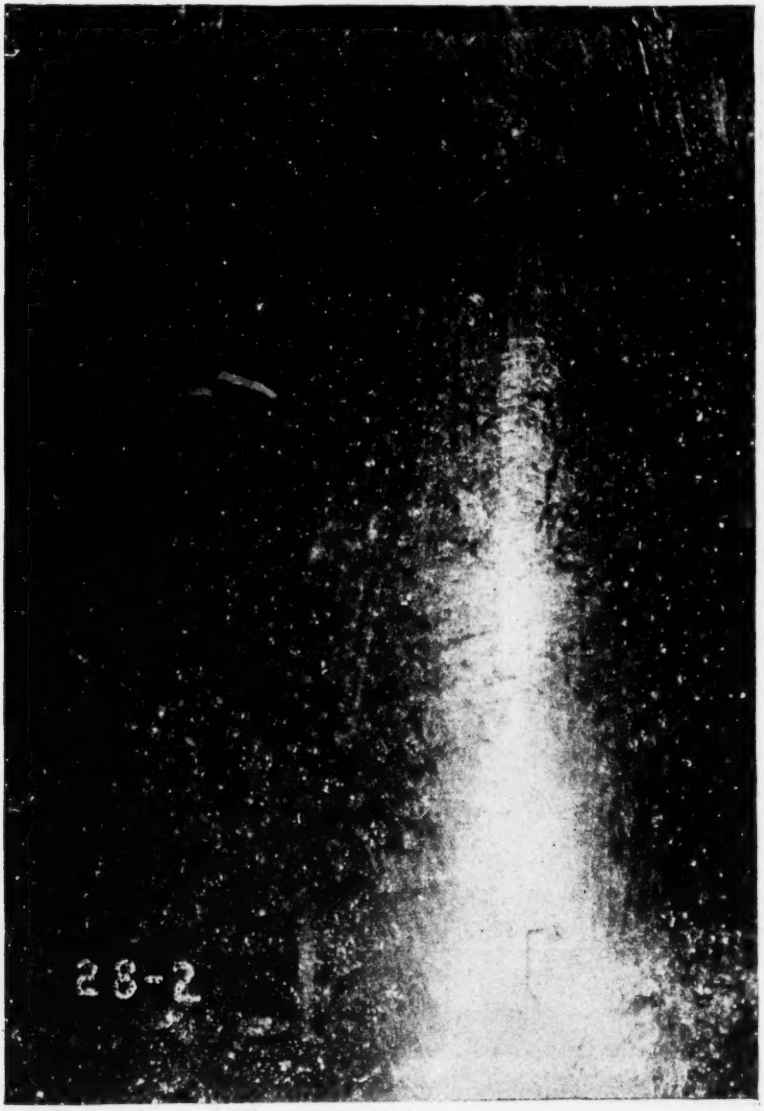
5129

Defendant's Exhibit No. 113.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5530

Defendant's Exhibit No. 114.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5131

Defendant's Exhibit No. 115.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5132

Defendant's Exhibit No. 116.

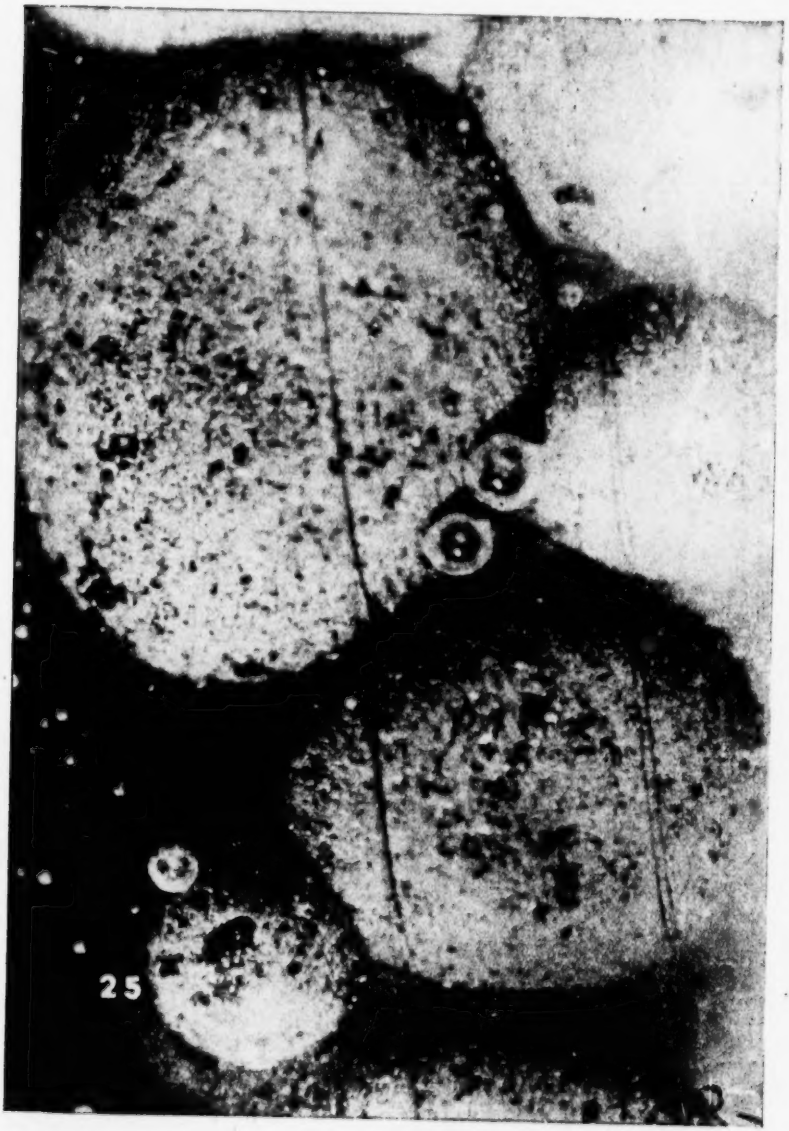
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 117.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5134

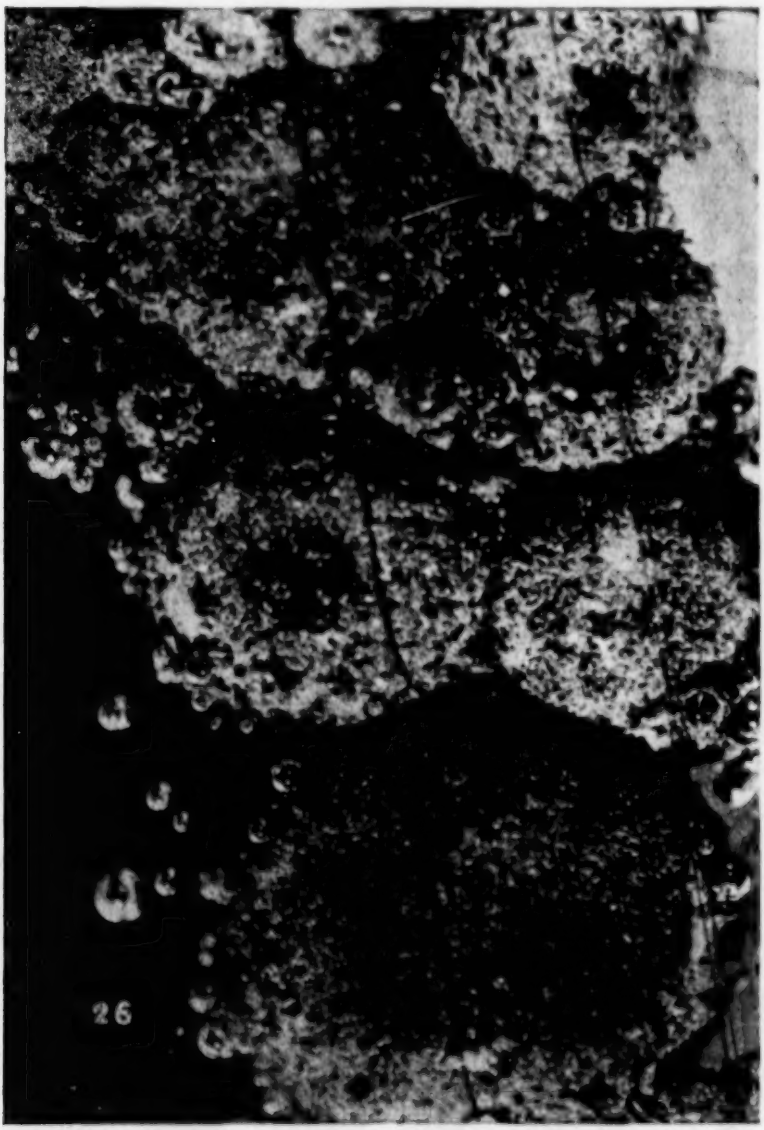
Defendant's Exhibit No. 118.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5135

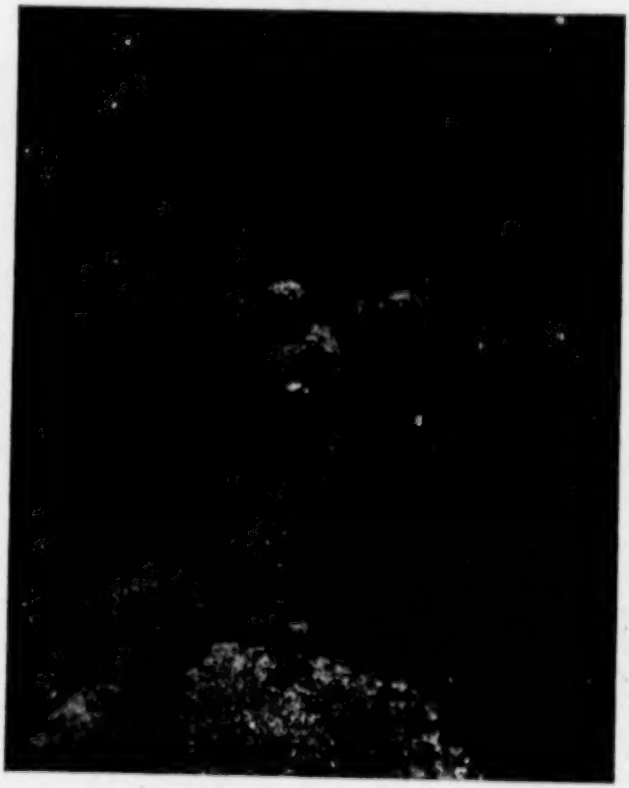
Defendant's Exhibit No. 119.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5136

Defendant's Exhibit No. 120.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 121.

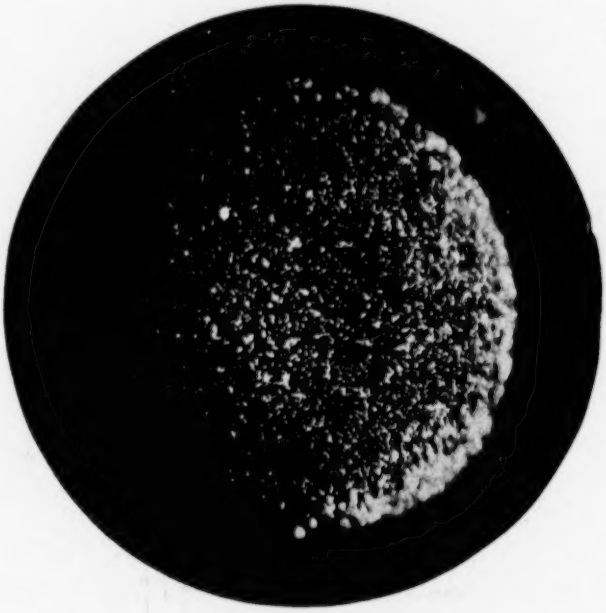
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5138

Defendant's Exhibit No. 122.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

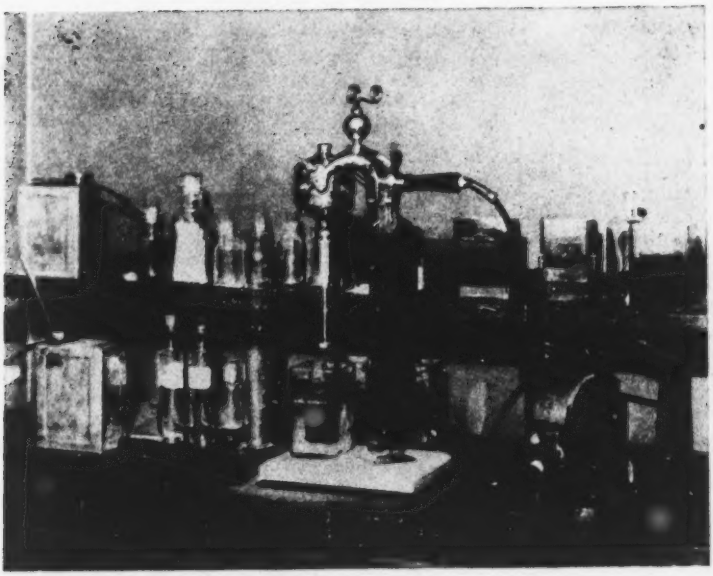
Defendant's Exhibit No. 123.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5139–40

Defendant's Exhibit No. 124.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

CHINO COPPER COMPANY
HURLEY PLANT

Record of Flotation Operations On the Treatment of Slime Vanner Tailings

DATE	FLOTATION HEADINGS: Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	FLOT. CONCTS.: Weight Dry Tons	Assay Percent Copper	FLOTATION TAILS: Assay Percent Copper	% Indicated Recovery	Initial Oil Pounds Per Ton	Oil in Circu'g Load Lbs. Per Ton	Total Oil Pounds Per Ton	Kind of Oil Used
1915											
Apr. 16-30	8,600	573	.96	157	12.78	.74	24.33	0.85			
May 1-25	27,750	1110	.93	495	11.13	.74	21.4	1.08			
June	None										
July 13-23	8,065	733	.74	434	4.23	.54	30.73	1.45			
3rd Quar.	90,104	1251	.72	1363	16.99	.48	34.88	1.20			
4th Quar.	299,522	3256	.78	2874	23.43	.56	28.81	1.02			
Year 1915	425,976	1812	.78	4889	19.95	.56	29.32	1.06			
1916											
1st Quar.	288,320	3168	.89	2952	21.13	.68	24.25	1.04			
2d "	280,424	3081	.79	2846	26.82	.52	34.36	1.45			
3d "	328,120	3566	.82	3516	27.35	.53	35.68	1.33			
4th "	352,810	3835	.82	3676	29.64	.52	37.39	0.96			
Year 1916	1,249,674	3414	.83	12990	26.47	.56	33.05	1.19			
1917											
Jan.	127,350	4108	.75	1204	31.89	45	40.49	1.10			
Feb.	124,900	4461	.78	1177	28.78	.51	35.23	0.53			
Mar.	136,170	4393	.71	1453	25.22	.44	37.89	1.46			
1st Quar.	388,420	4269	.74	3834	28.47	.47	37.84	1.04			
Aver. of all Oper. to Date	2,064,070	3127	.804	21713	25.352	.543	33.139	1.13			
Jan. 7	2,058		.98	19.	22.47	.78	24.07	9.72	*2.43	12.15	Jones Stove
Mar. 13	205		.67	3.3	9.10	.53	25.50	24.19			Coal Tar Stove
Mar. 14	122		.80	1.4	27.60	.48	41.00	22.80			Taft
Mar. 21	135		.69	1.4	25.10	.44	37.00	37.79			Sulphur
Mar. 27	2,300		.63	44.7	11.73	.41	36.20	32.27			Gashouse tar
Apr. 2	1,700		.61	21.0	14.87	.43	30.40	10.54			"
Apr. 2	1,965		.65	23.2	14.87	.48	27.00	.34			"
Apr. 4	3,250		.57	21.8	25.73	.40	30.30	8.10	3.2	11.3	

* Approximate quantity.

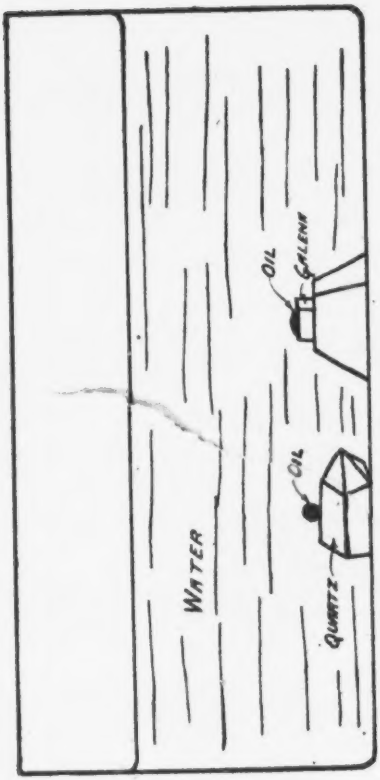
Recompiled at Butte.
April 19, 1917.

(Signed) O. WISER,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

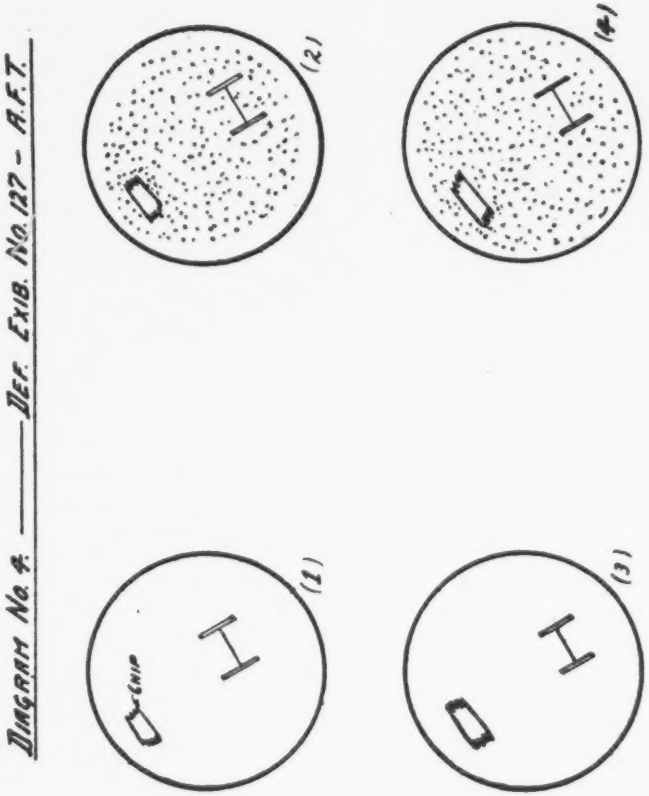
5142

DIAGRAM No. 3. —— DEF. EXH. No. 128 — A.F.T.



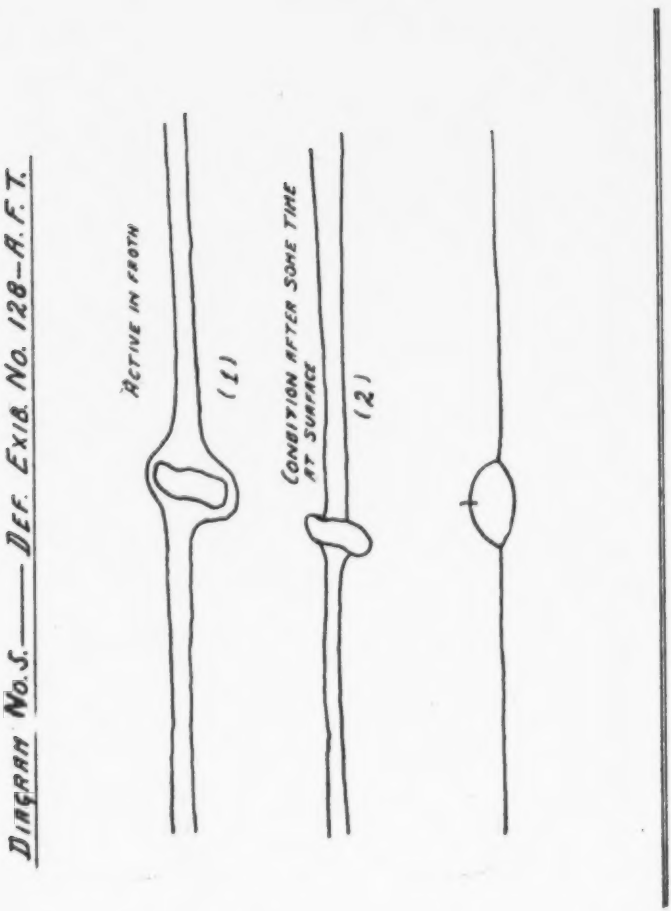
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5143



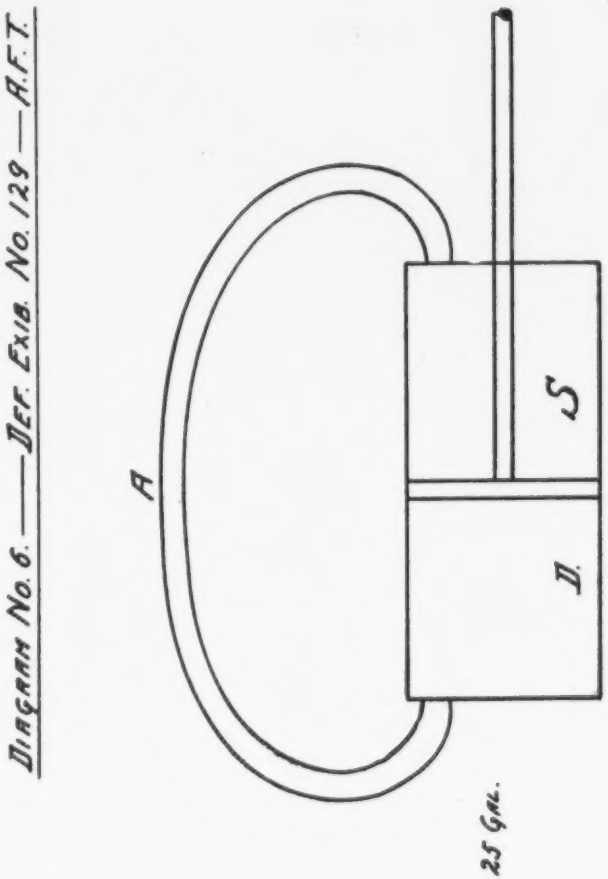
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5144



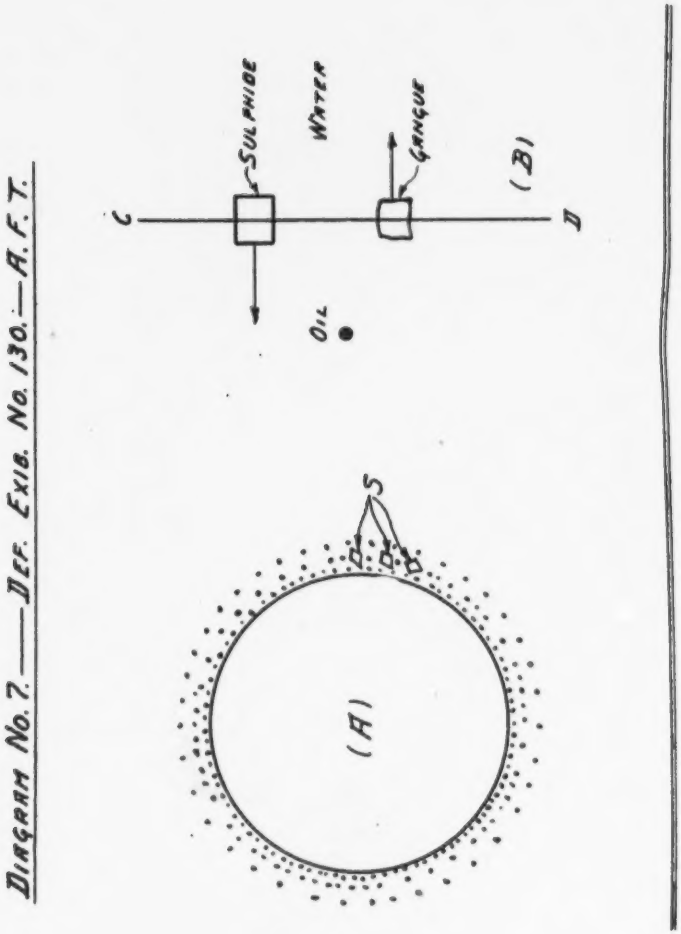
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5145



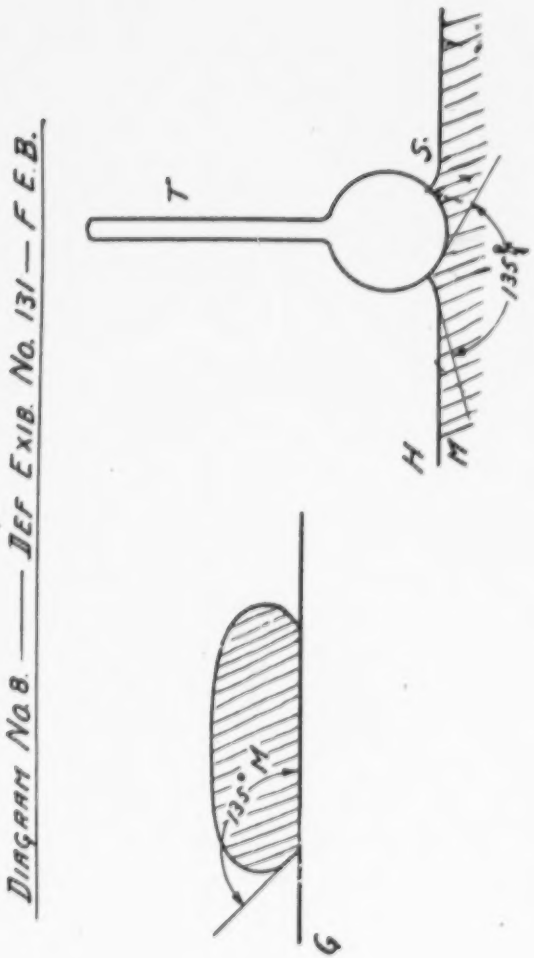
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5146



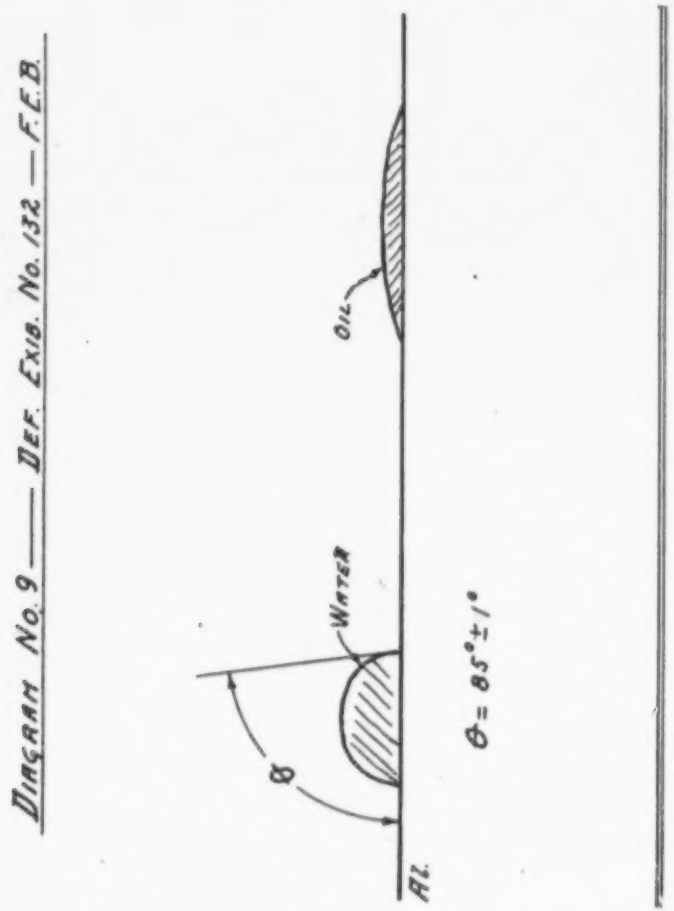
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5147



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

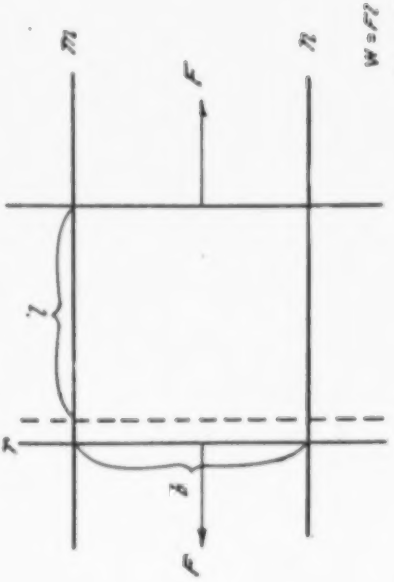
5148



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5149

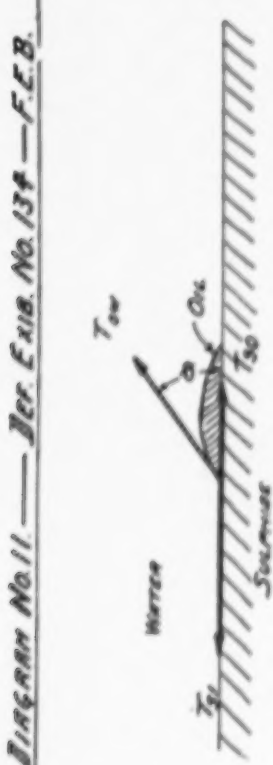
DIAGRAM No. 10.——DEF. EX 18. No. 133.—F. E. B.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5150

DIAGRAM NO. 11. —— DEF. EXHIB. NO. 134 —— F. E. B.



$T_{si} = T_{so} + T_{ow} \cos \theta$

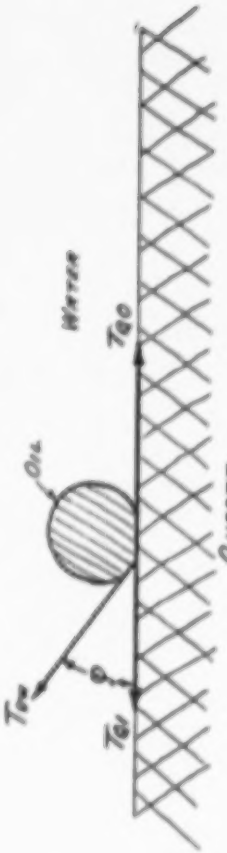
$T_{si} > T_{so}$

ASI TENDS TO DIMINISH WITH RESPECT TO A_{so}

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5151

DIAGRAM NO. 12.——DEF. EXH. NO. 135——F. E. B.



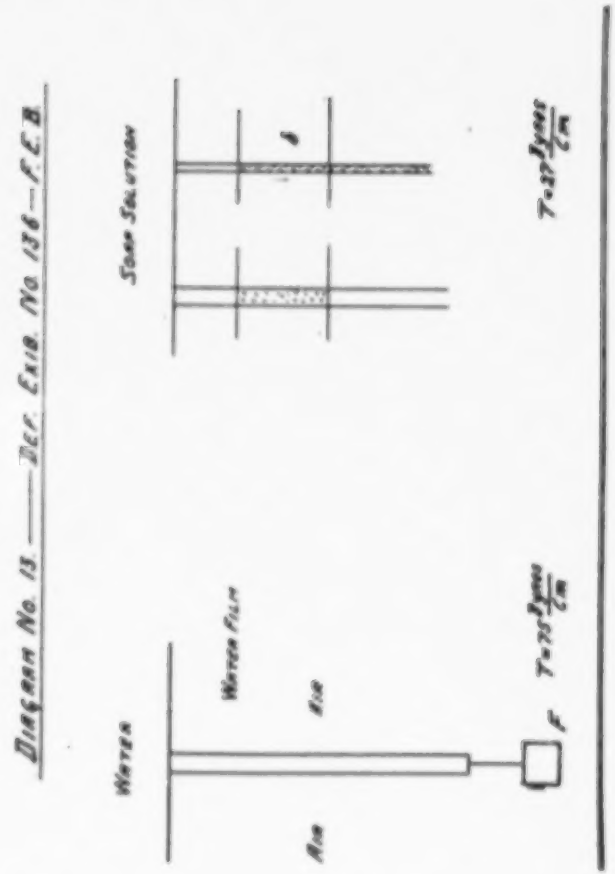
$T_{QO} = T_{QI} + T_{OW} \cos \phi$

$T_{QO} > T_{QI}$

A_{QO} DIMINISHES WITH INCREASE TO A_{QI}

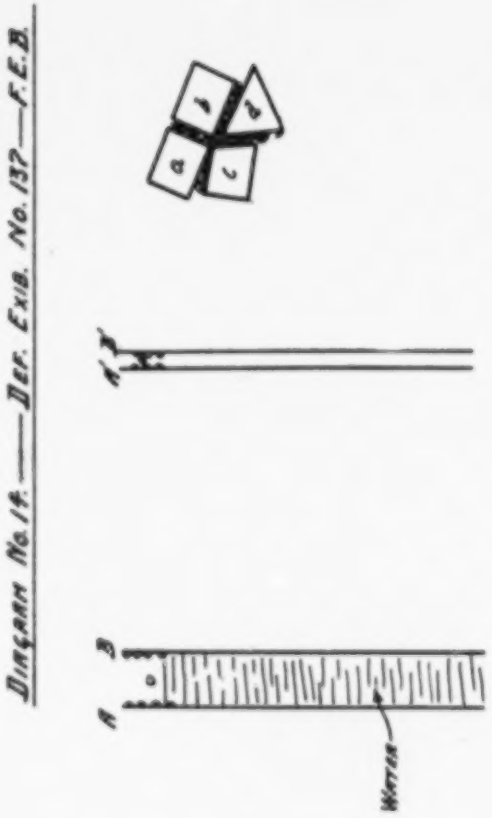
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5152



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5153

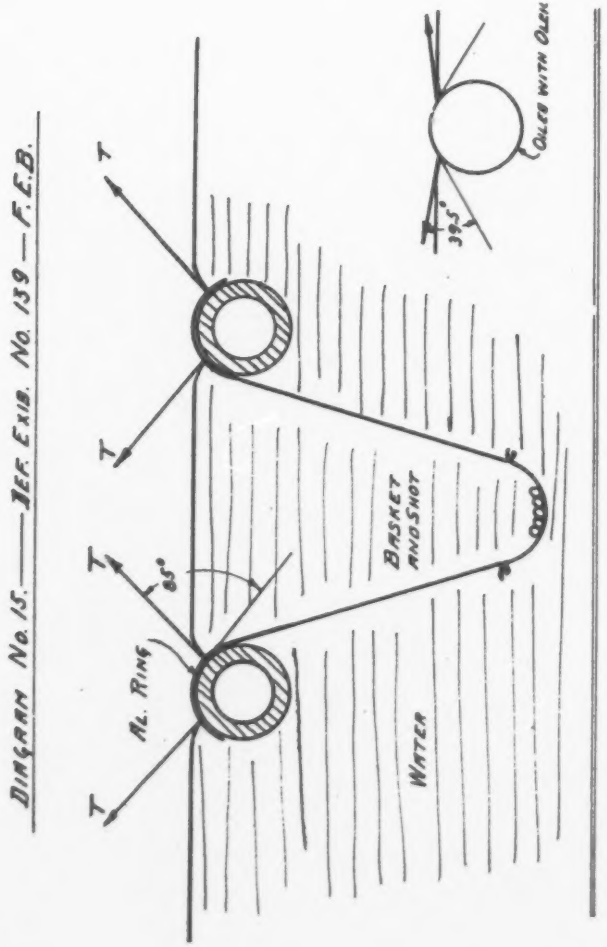


Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5154 Defendant's Exhibit No. 138.

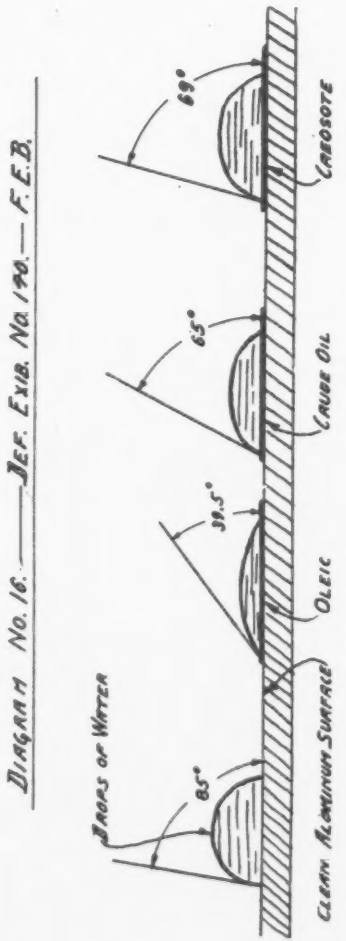
(Used by Mr. Williams to identify Prof. Taggart's article. This exhibit was identified but not admitted in evidence.)

5155



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

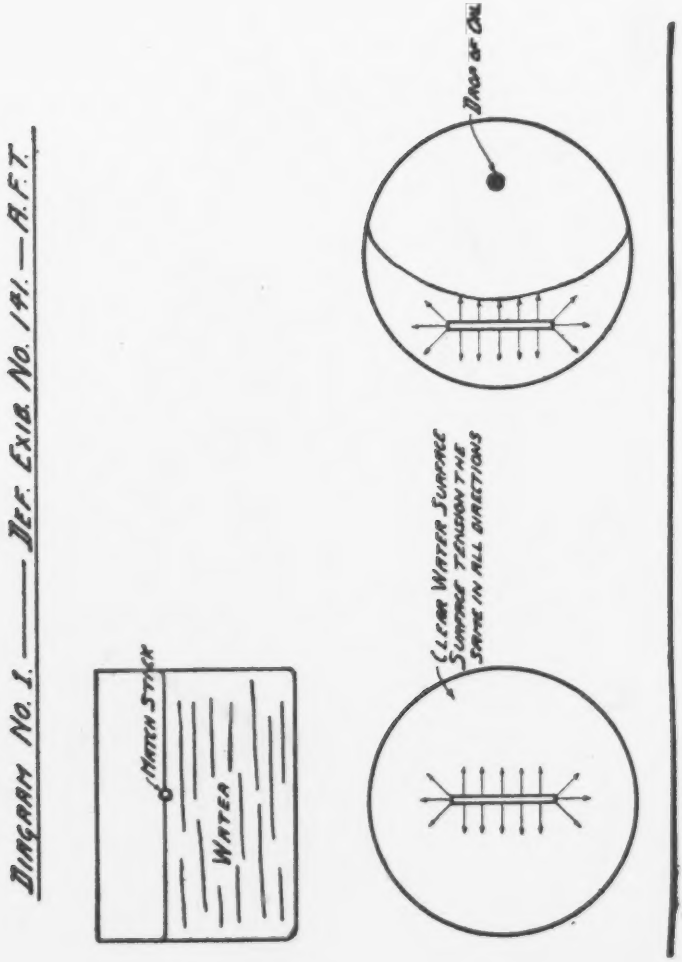
5156



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

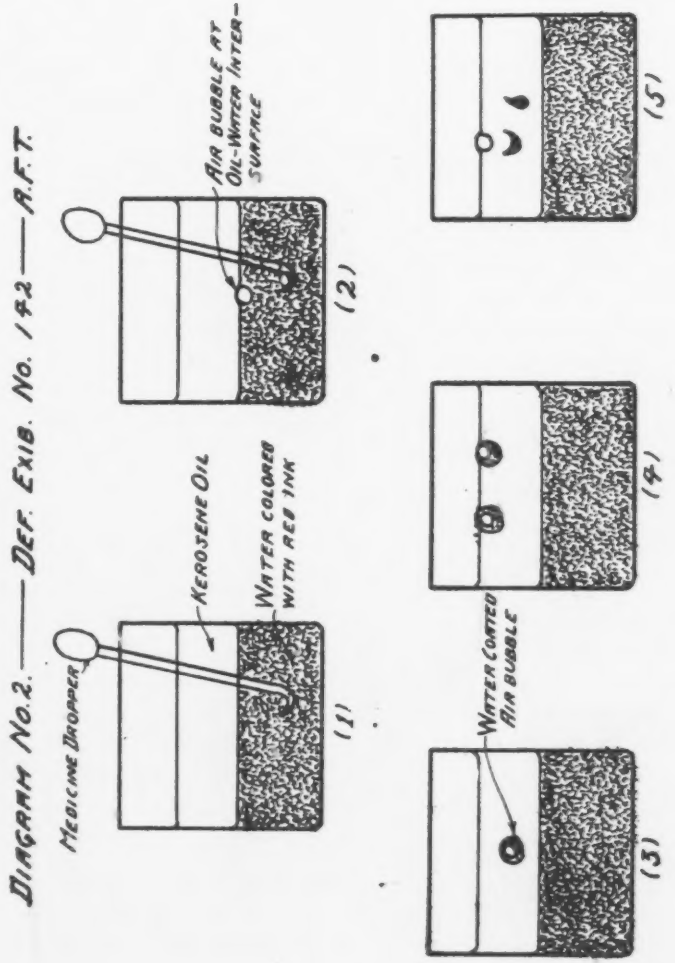
5157

DIAGRAM NO. 1. ——— DEF. EXH. NO. 141. —A.F.T.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5158



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 143.

5159

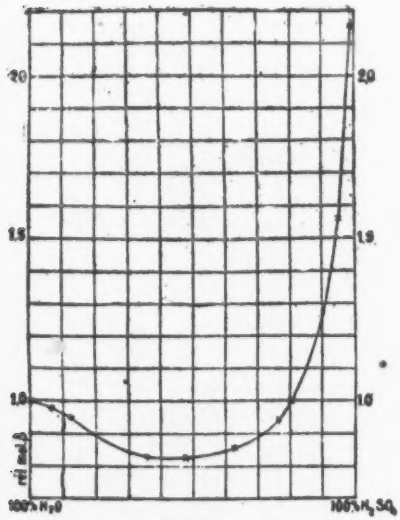


Fig. 14a.

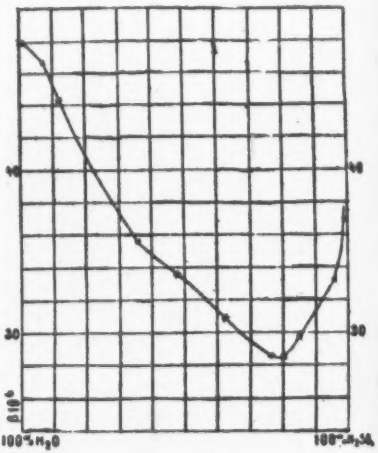


Fig. 14b.

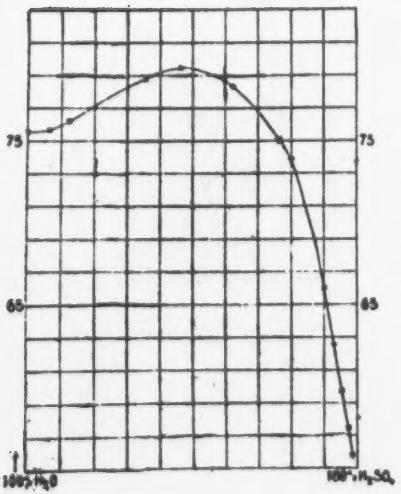


Fig. 14c.

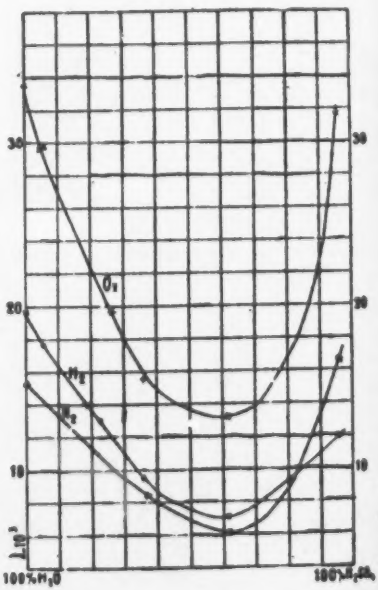
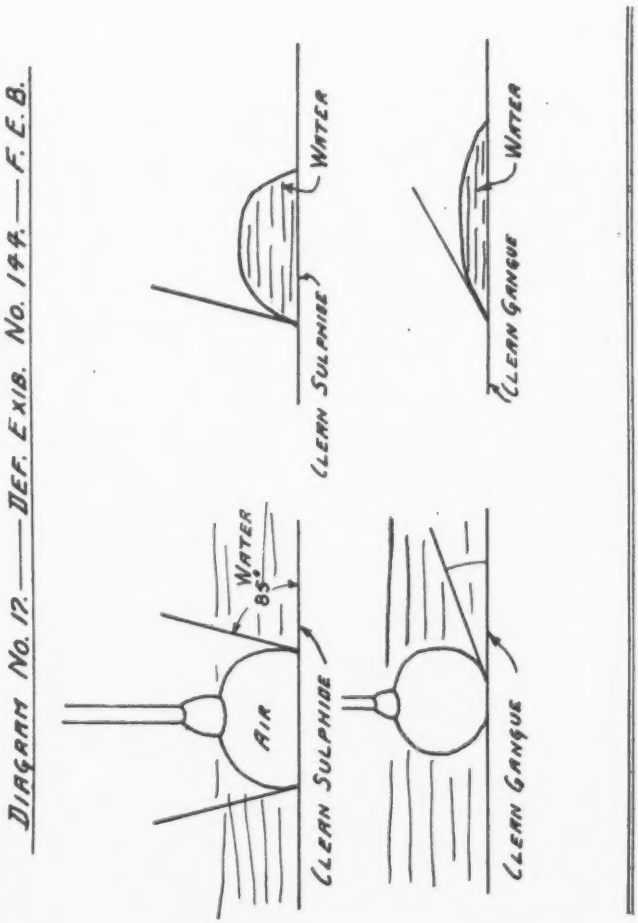


Fig. 14d.

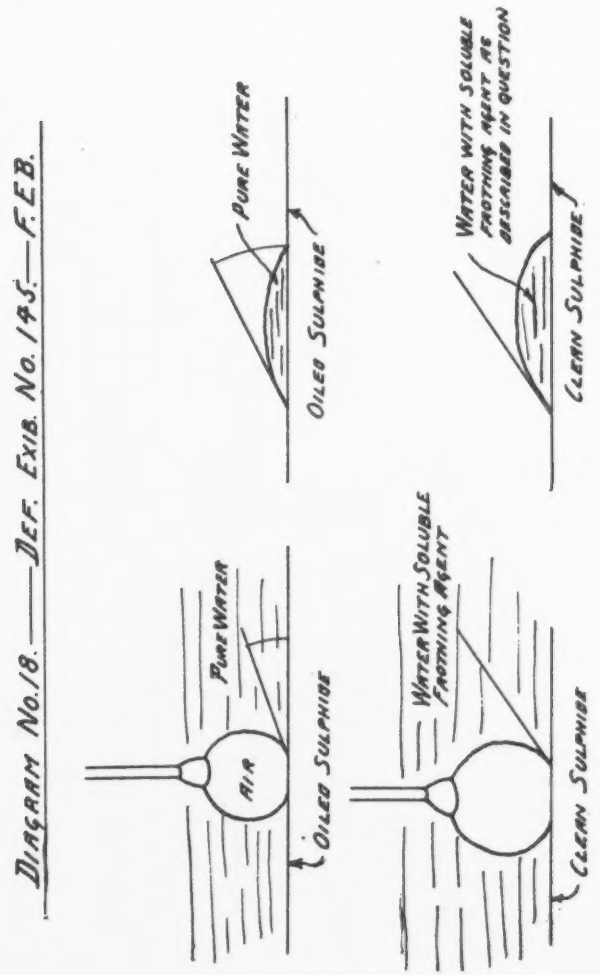
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5160



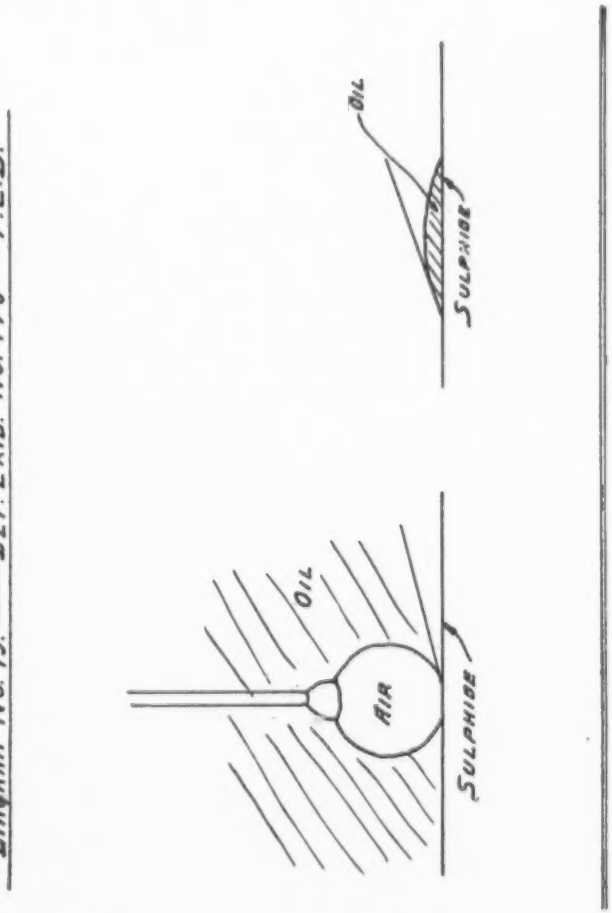
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5161



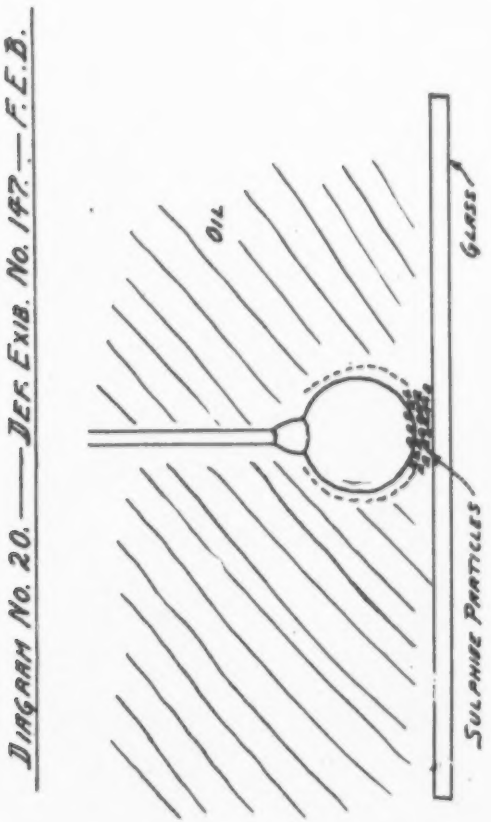
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5162



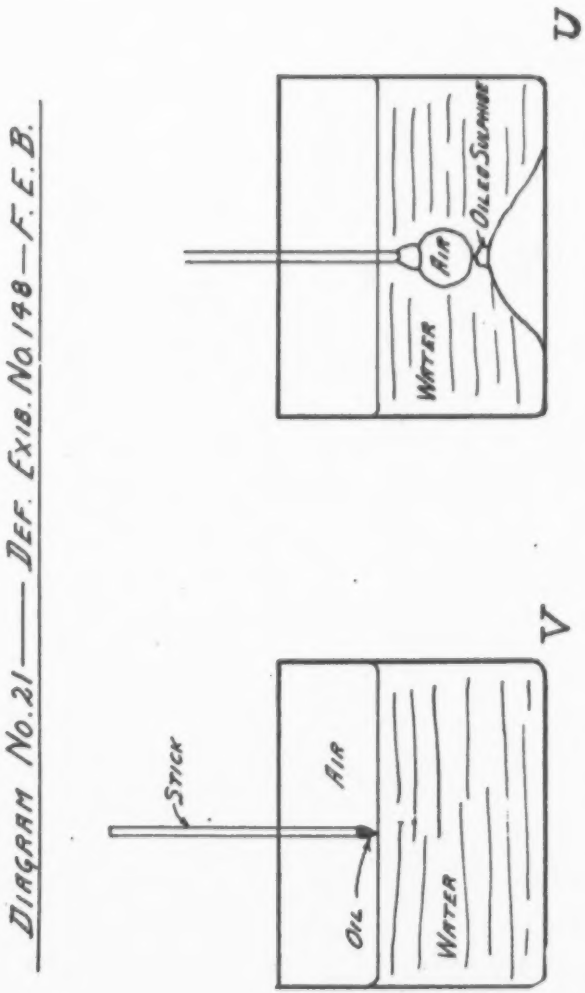
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5163



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

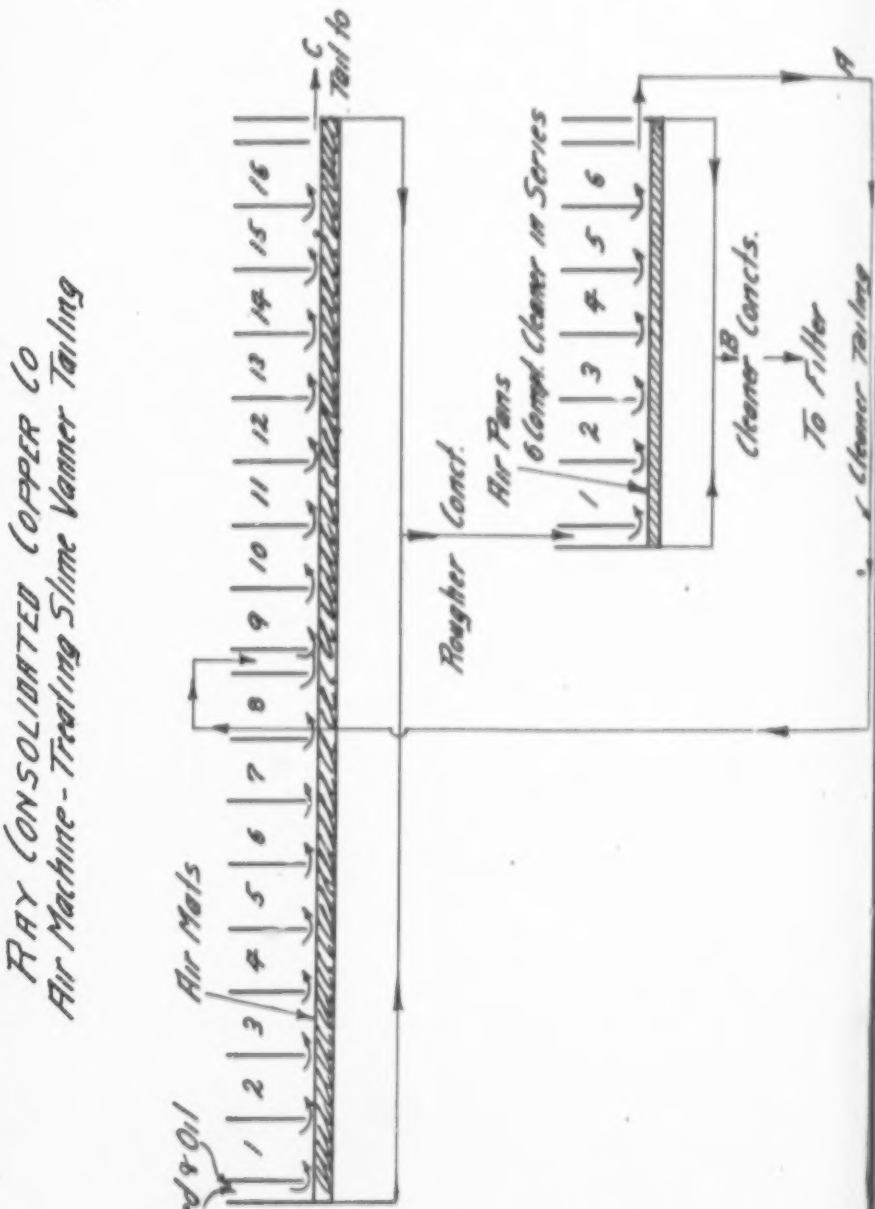
5164



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 149.

5165



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. B. Walker, Deputy.

Defendant's Exhibit No. 150.

Ray Consolidated Copper Company, Hayden Plant.

Flotation Operations.

Retreating Vanner Concentrate Products.

Period.	Flot. heads. Tons.	Flot. heads. Assay % cu.	Flot. concts. Tons.	Flot. concts. Assay % cu.	Tails. Assay % cu.	Flotation. Copper appr. %	Flotation. Recovery estm. %	New oils. Lbs. per ton.	Oil assays percents. Flotation heads including circul. load.	Oil assays percents. Concts.	Oil assays percents. Tails.
1914:											
4th Quarter.....	8821	6.87	1892	29.78	.617	92.94	92.94	4.31	...	...	...
1915:											
1st Quarter.....	17849	6.42	3752	28.94	.425	94.76	94.76	3.47	...	...	...
2d "	8802	5.60	1702	27.33	.397	94.28	94.28	5.28	...	...	...
3d "	17328	5.73	3797	24.17	.554	92.45	92.45	4.92	...	...	...
4th "	19558	6.12	4200	26.44	.574	92.64	92.63	4.42	...	...	...
Year	63537	6.029	13451	26.61	.502	93.439	93.436	4.41	...	...	...
1916:											
1st Quarter.....	20190	4.967	3629	25.37	.496	91.80	91.80	3.34	...	...	...
2d "	22750	5.460	4362	26.62	.441	93.47	93.47	3.23	...	...	...

Defendant's Exhibit No. 150.—*Continued.*

3d "	22750	5.840	4767	26.59	.316	95.73	95.73	3.22	...	...	...
4th "	27275	6.099	6086	26.38	.273	96.52	96.52	3.54	...	...	...
Year	92965	5.630	18864	26.30	.375	94.69	94.69	3.36	...	...	...
1917:											
January	9300	6.24	2267	23.99	.456	94.48	94.48	20.02	...	...	...
February	8550	6.63	2289	23.63	.422	95.33	95.33	18.77	1.07	2.87	.10
March	11063	6.70	3377	21.07	.368	96.19	96.19	21.19	.97	3.15	.033
1st Quar. Average.....	28913	6.531	7983	22.76	.412	95.42	95.42	20.10	1.01	3.03	.062

Hayden, 3/29/1917.
Copied Butte, Apr. 23, 1917.

(Signed) E. W. ENGLEMANN,
Flotation Foreman.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

BAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT

FLOTATION OPERATIONS

Treating Slime Vanner Heading & Slime Vanner Tailing

PERIOD	FLOT. HEADS Tons	FLOT. HEADS Assay % Cu.	FLOT. CONCTS. Tons	FLOT. CONCTS. Assay % Cu.	TAILS Assay % Cu.	FLOTATION Copper Appr. %	FLOTATION Recovery Estm. %	OILS Lbs. Per Ton	OIL ASSAYS PERCENTS Flotation Heads Including Circul. Load	Concts.	Tails
1915											
2d Quarter	33,721	1.170	1,045	20.84	.516	57.54	57.32	1.94			
3d "	95,051	1.122	3,464	11.40	.733	37.04	37.04	1.96			
4th "	163,144	.730	2,061	19.42	.493	33.40	33.31	1.52			
YEAR	291,916	.908	6,570	15.42	.572	38.20	37.67	1.71			
1916											
1st Quarter	206,621	.833	3,259	21.96	.498	40.80	40.80	1.40			
2d "	410,213	.748	5,162	26.45	.422	44.49	44.49	.84			
3d "	452,574	.752	6,632	25.28	.387	49.23	49.02	76			
4th "	557,764	.755	7,888	24.44	.416	45.73	45.67	.72			
YEAR	1,627,172	.762	22,921	24.71	.419	45.64	45.64	85			
1917											
Jan. 17 & 18	1,803	.813	24	27.31	.465	43.56	43.55	20.30			
Feb. 8 to 28	7,597	.668	188	12.22	.375	45.25	45.25	20.10	1.029	3.65	—
Mar. 1st to 14th, Inclusive	4,549	.653	104	10.25	.439	34.31	34.24	20.54			
Mar. 15th to 17th, Inclusive	2,000	.725	69	7.60	.368	24.36	23.40	24.31			
Mar. 20th to 26th, Inclusive	6,660	.731	52	17.97	.606	17.74	17.69	21.34			

NOTE:

Results from Feb. 8th to Mar. 14th were obtained when using coal tar oil mixtures on Air Machine. The construction of this machine is such that only one cleaning can be obtained. This corresponding product, on our large installation receives a double, or two recleanings, thus raising the grade of concentrate to 25.00% Cu. Our corresponding primary concentrate when using less than 1 pound of oil per ton material treated will average 12.00% Cu. The results on January 17th and 18th were obtained when using straight Coal Tar, those on March 15th to 17th, inclusive were using Smelter fuel oil and Barrett No. 4 oil, while those on March 20th to 26th inclusive were obtained when using Flotco No. 20 and No. 21 oil with small amounts of Pine oil. The results on January 17th and 18th and March 15th to 17th and March 20th to 26th were obtained at No. 1 Pyramid as a Roughing Machine followed by the Air Machine as cleaners, thus giving the rougher concentrate a double recleaning. This flow sheet is similar to our installation when operating with less than 1 pound of oil per ton.

Hayden, Mar. 29th, 1917.
Copied Butte, Apr. 23, 1917.

(Signed) E. W. ENGELMANN,
Flotation Foreman.

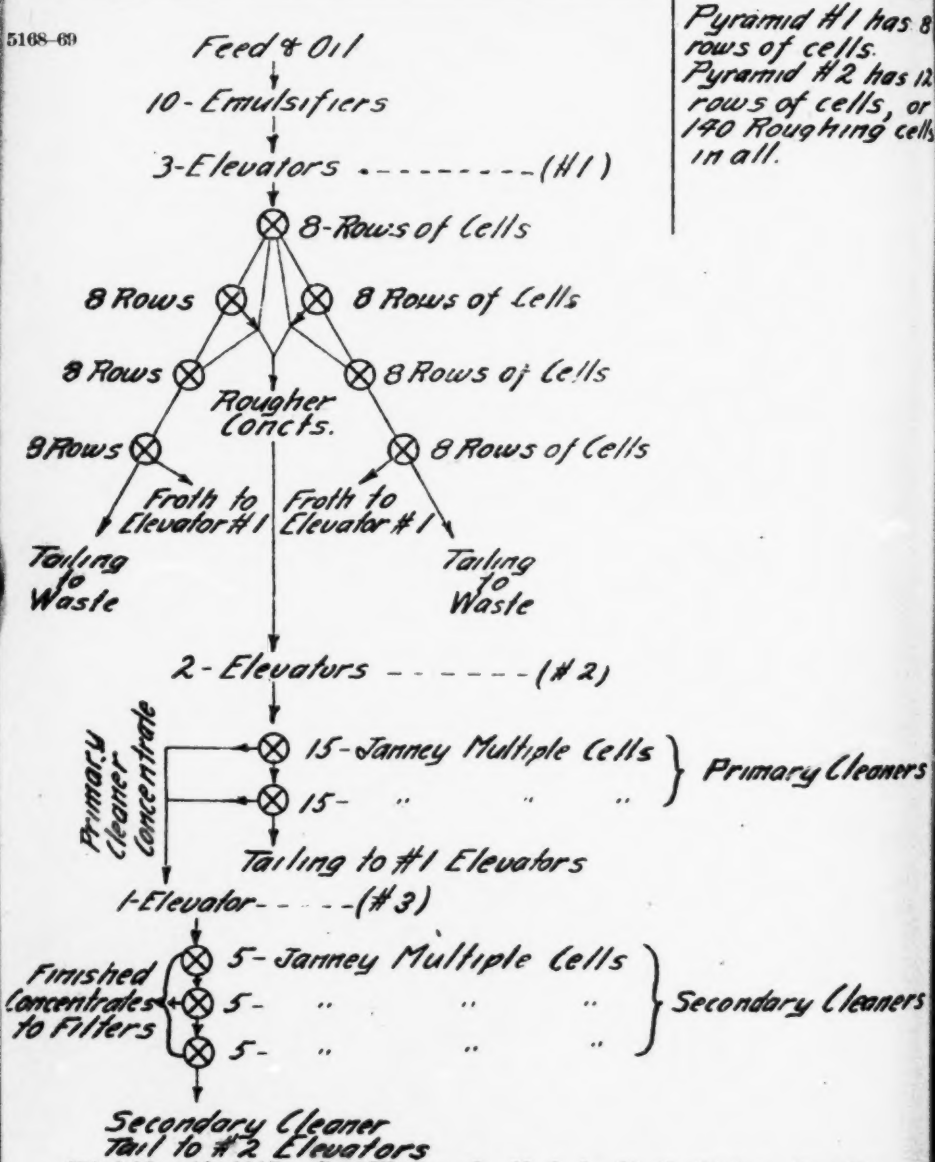
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

BUTTE & SUPR. MNG. CO. VS. MIN. SEP., LTD., ET AL. 2875
Defendant's Exhibit No. 151.

Defendant's Exhibit No. 152.

JANNEY MECHANICAL AIR CELLS
On Pyramid Installation Treating Slime Vanner Tailing

5168–69



Pyramid #1 has 8 rows of cells. Pyramid #2 has 12 rows of cells, or 140 Roughing cells in all.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 154.

RAY CONSOLIDATED COPPER COMPANY
Hayden Plant
COMPARATIVE RESULTS OBTAINED ON AIR MACHINES AND RETREATING MACHINES WHEN CONSUMING MORE THAN 1% OF OIL PER TON AND ALSO ½ OF 1% OIL PER TON, USING THE SAME OIL MIXTURE THROUGHOUT.

DATE	Product Treated	Kind of Oil	Original Lbs. Oil Per Ton	HEADING		CONCENTRATE		Tails Assay % Cu.	Indicated Extraction %	% Solids	Pounds Oil per Ton Heads Incl. Cir. L.	PERCENT OIL	
				Tonnage	Assay % Cu	Tonnage	Assay % Cu.					Concts.	Tails
Mar. 30, 31 and April 1	Retreating Plant Feed	90% Fuel and 10% Barrett No. 4	22.24	1125	6.14	309	21.48	.326	96.14	23.60	20.90	3.25	.035
April 3d, 4th and 5th	Retreating	90% Fuel and 10% Barrett No. 4	11.27	1133	6.24	321	21.28	.290	96.67	22.23	10.80	1.82	.022
Mar. 30th, 31st and Apr. 1st	Slime Vanner Tailing	Straight Coal Tar	22.41	795	.687	33	7.75	.375	47.63	24.19	22.83		
Apr. 3d, 4th and 5th	Slime Vanner Tailing	Straight Coal Tar	11.20	772	.660	22	10.64	.366	46.15	25.81	10.95	3.95	.445
RESULTS OBTAINED WHEN ELIMINATING FUEL OIL FROM OIL MIXTURES													
Apr. 7th	Retreating Plant Feed	Straight Barrett No. 4	2.39	344	6.30	63	29.56	1.083	85.95	20.47			
Apr. 8th	Retreating Plant Feed	Straight Barrett No. 4	1.31	356	6.20	54	34.16	1.25	82.89	20.35			
Apr. 7th	Slime Vanner Tailing	Straight Barrett No. 4	2.07	245	.676	4	12.56	.456	33.65	26.63			
Apr. 8th	Slime Vanner Tailing	Straight Barrett No. 4	1.13	273	.720	3	18.13	.543	25.39	27.81			

NOTE—The oils used on retreating machine were as indicated above. The only variation from oil mixtures indicated was an occasional addition of a small amount of pine oil when an unusual amount of coarse feed entered the machine.

This pine was never used continuously and was of so minnte a quantity that the operator failed to record same. This practice, however, was maintained throughout entire tests regardless of amount of original oil mixture added at head of machine.

NOTE 2—

Pine oil is never used in this manner on machines treating our flotation slime feed.

When using straight Barrett No. 4, the bubble is brittle and somewhat delicate and has a tendency to burst when coming to the surface, thus causing the coarse mineral particles to drop. This oil is a very good frothing agent and also acts somewhat as a carrying oil, but the latter characteristic is not sufficient to strengthen the bubble enough to carry the larger mineral particles, especially when acting in feeds carrying large percentages of mineral.

When using mixtures of Barrett No. 4 and Fuel Oil, the latter has the faculty of strengthening the creosote bubble sufficient to carry mineral particles which would ordinarily drop if using straight Barrett No. 4.

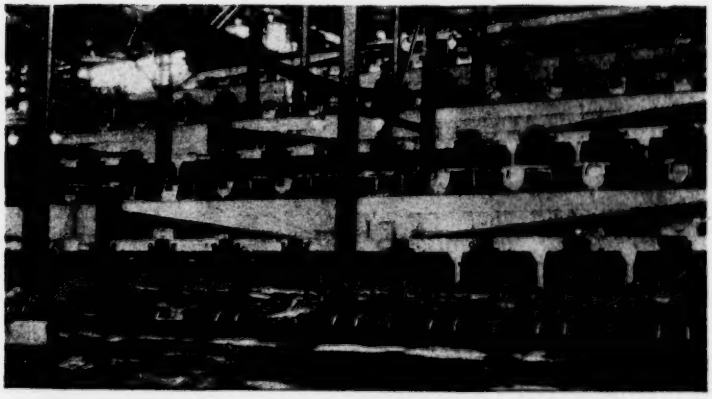
(Signed) E. W. ENGLEMANN
Flotation Foreman

Hayden, Ariz., Apr. 9th, 1917.
Copied Butte Apr. 23d.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5170

Defendant's Exhibit No. 153.

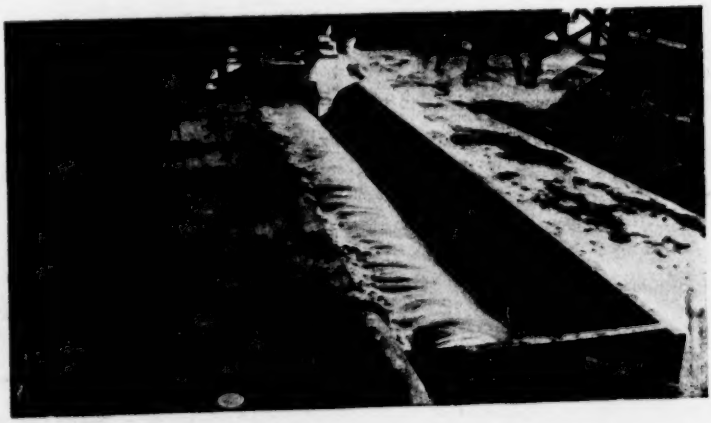


Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follows Defendant's Exhibit 154, marked pages 5171-74.)

5175-76

Defendant's Exhibit No. 155.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 156.

Exhibit 156
A water
F
F
D
B Tailing to waste
C. Concts discharge
STANDARD K. & K. FLOTATION MACHINE
TYPE A 2612
SOUTHWESTERN ENGINEERING CO., LOS ANGELES, CAL.
FLOOR SPACE - - - 5'-1" - - - COMPLETE UNIT
HEIGHT - - - - 32" - - - NO BLOWER
CAPACITY - - - 80 TO 100 TONS - NO COMPRESSED AIR
POWER - - - - 8 TO 10 H. P. - NO PREAGITATORS
PRICE F. O. B. LOS ANGELES Steel Construction, wt. 3500 lbs. $1
Wood Construction, wt. 3300 lbs.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

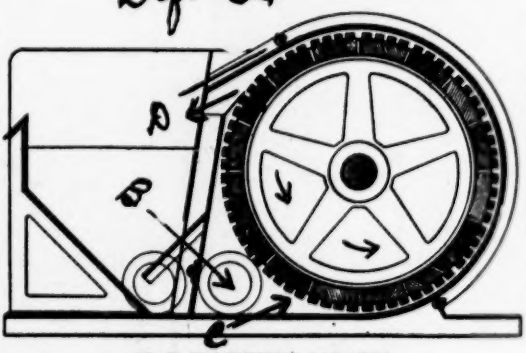
5179 Defendant's Exhibit No. 157.

(Page One)

THE K & K FLOTATION MACHINE

— BULLETIN NO. 1 —

Def. Ex 157



U. S. PATENTS 1174739

OTHERS PENDING

Foreign Patents Applied for.

SOUTHWESTERN ENGINEERING CO.,

Consulting Mining, Metallurgical, Mechanical and Electrical Engineers.

523-524 Wesley Roberts Building,
LOS ANGELES, CALIFORNIA.

Mine Examination
Ore Treatment Problems
Ore Testing Laboratory
Concentration and Flotation Tests

5180 Defendant's Exhibit No. 157.

(Page Two.)

D. D. Bisbee, Elect., & Mech., Engineer.
L. C. Penhoel, Mining Engineer.
Max Kraut, Metallurgical Engineer.

(Page Three.)

Description.

The Machine consists essentially of a long, hollow, cylindrical drum, mounted on a horizontal shaft. This drum is provided with a series of longitudinal air slots and a larger number of longitudinal riffles running the entire length of the drum. The drum is rotated rapidly inside of a close fitting casing and the whole enclosed in a suitable housing as shown in the accompanying illustration. A discharge lip placed tangentially to the periphery of the drum provides for taking the pulp into the frothing box and a controllable intake passage at the bottom of the frothing box provides for returning the pulp to the aeration chamber for retreatment.

Operation.

The machine is very simple, having automatic tailings discharge and level control. One man can take care of any number of machines.

Adaptability.

Machine can be run in the ordinary flow sheet in flotation work, or else can be run as an independent unit adding the oil directly to the machine.

Labor and Care.

The machine is self regulating and requires no attention otuside of keeping the bearings oiled properly.

5181-82-83 Defendant's Exhibit No. 157.

(Page Four.)

Some Superior Points.

1. Large capacity in a comparatively small floor space.
2. Little head room required.
3. Simplicity of construction.
4. Automatic control of machine, requiring little or no attention.
5. Low power consumption, due to the fact that churning and agitation are avoided, and air taken in at atmospheric pressure by suction.
6. Only wearing parts are riffles, which when worn out can be readily replaced.
7. Sands do not interfere with working of machine.
8. Settling of sands in frothing box and choping of machine is impossible.
9. With some ores machine can be operated as an independent unit, the oil being fed directly into machine.
10. Machine has no stuffing boxes and therefore no friction losses except in bearings.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Defendant's Exhibits Nos. 158 to 163, inclusive, marked pages 5184-87, 5189, and 5192-98.)

Defendant's Exhibit No. 158.

BUTTE AND SUPERIOR MINING COMPANY
FLOTATION OPERATIONS

PERIOD	Flot. Plant Feed: Ore to Flot. Plant: Dry Tons	Flot. Plant Feed: Ore to Flot. Plant: Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation): Per Cent Zinc	Flot. Concts.: Dry Tons	Flot. Concts.: Per Cent Zinc	Flot. Tailings: Per Cent Zinc	Flot. Zinc Recovery: Apparent	Flot. Zinc Recovery: Estimated	Acid: Pounds Per Ton	OIL - AMOUNT AND ANALYSIS: Per Ton Ore to Flotation: Pounds Added	Per Ton Ore to Flotation: Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil Per Ton Contained in Ore & Circulating Middling Treated in Flot.	Per Cent Oil in Concs.	Per Cent Oil in Tailings
1913															
1st quarter	47,555	16.43		11,089	45.76	7.44	65.34	64.56	1.68	4.76	0.24				
2nd quarter	49,698	15.28		13,811	46.09	3.05	85.71	83.86	3.41	9.82	0.49				
3rd quarter	72,935	15.42		19,871	48.19	2.88	86.49	85.16	7.05	4.14	0.20				
4th quarter	85,939	14.05		20,836	49.63	2.78	84.97	85.62	8.45	4.78	0.24				
Year	256,127	15.14		65,607	47.80	4.05	80.03	80.87	5.60	5.58	0.28				
1914	287,247	14.14		64,420	53.03	2.56	86.08	84.12	12.00	2.22	0.11				
1915	471,478	13.66		107,348	54.82	1.73	90.18	90.36	7.81	1.49	0.07				
1916															
3rd quarter	126,417	12.89		28,882	53.92	1.06	93.62	92.73	5.38	1.67	0.08				
Year	583,937	13.36		133,785	53.83	1.20	92.63	92.33	5.25	1.43	0.07				
Dec. 22, 1916-															
Jan. 7, 1917	23,901*	12.64		5,222	51.72	1.48	90.89	89.50	3.16	3.06	0.15				
Jan. 9-16	14,651	12.87		2,680	48.22	4.13	74.27	68.60	20.55	24.90	1.24				
Jan. 17-29	19,158	13.48		4,587	47.68	2.18	87.86	84.70	13.41	16.75	0.84				
Jan. 30-Feb. 3	8,863	12.36		2,211	49.06	1.64	89.73	99.20	11.65	16.05	0.80				
Jan. 7-Feb. 6	47,85	12.99		10,546	48.45	2.70	83.89	82.30	14.70	20.23	1.01				
Feb. 4-28	36,26	13.29	20.25	8,556	46.69	1.97	88.93	82.86	10.29	20.07	1.00	1.27	25.40	1.86	0.35
Mar. 1-20	30,25	12.72	22.70	7,194	47.50	1.54	90.84	88.87	9.81	21.30	1.06	1.50	30.00	2.29	0.69
Mar. 21-31	17,1	12.55	29.18	3,651	47.40	2.89	81.97	80.46	10.15	22.86	1.14	1.46	31.20	2.45	0.71
Apr. 1-15	24,298	13.09	22.42	5,852	46.32	2.38	86.25	85.21	9.98	23.91	1.19	1.34	26.80	2.09	0.70

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 159.

BUTTE AND SUPERIOR MINING COMPANY

FLOTATION PLANT RECORD — **JANUARY, 1917**

DATE	Flotation Plant Feed: Dry Tons	Flotation Plant Feed: Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation): Per Cent Zinc	Flot. Concentrates: Dry Tons	Flot. Concentrates: Per Cent Zinc	Flot. Tailings: Dry Tons	Flot. Tailings: Per Cent Zinc	Flot. Zinc Recovery: Apparent	Flot. Zinc Recovery: Estimated	OIL—AMOUNTS AND ANALYSIS: Per Ton Ore to Flotation: Pounds Added	Per Ton Ore to Flotation: Per Cent Added	Per Cent Oil in Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
Jan. 9	1,837	11.62	21.40	163	51.80	1,674	7.15	44.63	39.57	10.80	0.540	2.63	52.60	1.46	1.80	1
Jan. 10	1,690	13.46	20.90	262	50.90	1,428	6.45	59.64	58.61	16.25	0.812	2.47	49.40	1.88	2.28	2
Jan. 11	953	12.20	19.10	180	44.20	773	3.84	75.04	68.42	18.95	0.548	3.28	65.60	1.40	3.45	3
Jan. 12	1,564	11.16	25.20	244	46.80	1,320	4.34	67.36	65.44	16.82	0.841	0.66	13.20	1.95	2.57	4
Jan. 13	1,288	13.12	22.90	279	47.30	1,009	2.80	83.60	78.08	16.09	0.804	1.31	26.20	1.53	0.98	5
Jan. 14	1,065	13.27	18.40	269	45.40	796	1.89	89.48	86.43	22.55	1.128	1.92	38.40	2.44	1.37	6
Jan. 15	1,502	12.72	21.20	319	45.50	1,183	3.05	81.48	75.97	16.71	0.835	1.19	23.80	1.36	0.97	7
Jan. 16	1,381	11.60	21.30	303	44.30	1,078	2.40	83.85	83.77	21.09	1.054	1.26	25.20	1.92	0.85	8
Jan. 17	1,352	12.72	19.30	311	47.00	1,041	1.90	88.65	84.96	12.46	0.623	1.32	26.40	1.09	1.49	9
Jan. 18	1,468	13.02	17.60	336	48.10	1,132	2.15	87.39	84.58	13.83	0.697	2.43	48.60	1.63	1.16	10
Jan. 19	1,397	14.73	14.70	360	50.20	1,037	1.16	94.30	87.75	16.68	0.834	1.72	34.40	1.77	1.20	11
Jan. 20	1,525	14.26	16.70	403	49.50	1,122	1.41	92.75	91.73	13.10	0.655	1.34	26.80	1.87	1.09	12
Jan. 21	1,537	14.47	15.80	428	45.60	1,109	1.57	92.32	87.73	9.98	0.499	1.30	26.00	2.22	1.10	13
Jan. 22	1,600	14.26	16.90	465	43.60	1,135	1.53	92.51	88.87	15.45	0.773	1.62	32.40	1.90	1.16	14
Jan. 23	1,579	13.90	16.00	384	47.50	1,195	2.72	85.31	83.11	18.29	0.914	1.29	25.80	0.91	1.57	14
Jan. 24	1,667	13.28	20.00	365	49.10	1,302	2.87	83.25	80.93	16.58	0.829	2.56	51.20	3.26	2.39	15
Jan. 25	1,591	13.70	22.10	305	51.20	1,286	4.35	74.58	71.63	18.32	0.916	1.89	37.80	2.43	1.79	16
Jan. 26	267	10.80	22.20	37	46.50	230	4.46	65.45	59.64	11.27	0.563	2.32	46.40	1.81	1.43	17
Jan. 27	1,786	12.45	17.00	389	46.70	1,397	2.03	87.49	81.73	11.93	0.597	2.11	42.20	2.14	1.94	18
Jan. 28	1,868	12.69	14.20	435	45.90	1,433	1.10	93.57	84.20	15.01	0.750	1.33	26.60	1.91	1.17	18
Jan. 29	1,492	13.14	14.20	369	47.40	1,123	1.05	94.09	89.18	8.06	0.403	1.36	27.20	1.61	1.87	18
Jan. 30	1,525	10.42	15.30	317	48.00	1,208	1.21	90.67	95.80	14.02	0.701	0.56	11.20	1.08	0.25	18
Jan. 31	1,841	12.37	19.40	594	50.10	1,247	2.03	87.12	130.70	12.63	0.632	0.60	12.00	1.41	0.26	18
Jan. 9-31	33,775	12.91	18.77	7,517	47.52	26,258	2.83	83.02	81.92	14.75	0.738	1.67	33.40	1.40	1.49	

W.A.S.
T.F.S.
J.B.K.
D.C.H.
B.H.D. 2
J.L.B. April 14th. 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 160.

BUTTE AND SUPERIOR MINING COMPANY

Below is a statement of the percentages of oils in the various mixtures used in the flotation plant during the months of January, February and March, as well as April.

No.	Kerosene	Jones Crude	No. 1 Creosote	No. 2 Creosote	Fuel	Pine	No. 4 Barrett	Tar	Par affin Base
1	60%	%	15%	25%	%	%	%	%	%
2	67		3	29		1			
3			83	10		7			
4	61	2	34			1		2	
5	78		4	18					
6	70	3		27					
7	72		3	20		3	2		
8	74					14	12		
9	75					20	5		
10	55	7		2		34	1		
11	38	40				18	4		
12	64	30	1	2					3
13	60	14				11			15
14	31	59				10			
15	42	46				12			
16	28	62	1			9			
17	40	51		1		8			
18	21	69				10			
19	25	18	49			8			
20	27	7	60			6			
21	28	24	12	36					
22	47	8		4	31	10			
23					34	16			
24					95	5			
25	17				71	12			
26	10				85	5			
27	23	72				5			
28	10	70				20			
29	2				92	6			
30	10				80	10			
31	10				75	15			
32	8	45			31	16			
33		41			48	11			
34	22	39			24	15			
35	13	2			61	24			
36	35				50	15			
37	20				65	15			
38					80	20			
39	15				65	20			
40	15				75	10			
41	5	75			10	10			
42	10	55			15	20			
43	10	50			20	20			
44	10	10			65	15			
45	10				75	15			
46	5		15		70	10			
47	5		35		50	10			
48	10		10		70	10			
49	20				70	10			
50	18		2		70	10			
51	9	32	3		38	18			
52	10	70			5	15			
53	10	40			40	10			

April 19th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H H. WALKER, Deputy.

Defendant's Exhibit No. 161.

BUTTE AND SUPERIOR MINING COMPANY

FLOTATION PLANT RECORD — **FEBRUARY, 1917**

DATE	Flotation Plant Feed		Flotation Machine Feed	Flot. Concentrates		Flot. Tailings		Flot. Zinc Recovery		OIL—AMOUNTS AND ANALYSIS						
										Per Ton Ore to Flotation						
	Dry Tons	Per Cent Zinc	(Ore to Flot. Plant plus Circulating Middling Treated in Flotation) Per Cent Zinc	Dry Tons	Per Cent Zinc	Dry Tons	Per Cent Zinc	Apparent	Estimated	Pounds Added	Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
Feb. 1	1,863	12.114	18.90	401	50.20	1,462	1.41	90.91	89.20	10.77	0.539	0.64	12.80	1.45	0.30	18
Feb. 2	1,608	13.465	15.30	413	49.00	1,195	1.13	93.77	93.46	13.94	0.697	0.70	14.00	1.34	0.31	18
Feb. 3	1,981	14.150	17.40	486	48.00	1,495	2.42	87.30	87.64	17.78	0.889	0.73	14.60	1.36	0.47	19
Feb. 4	1,843	11.750	18.50	356	50.70	1,486	2.12	85.53	83.38	19.83	0.992	0.74	14.80	1.12	0.42	20
Feb. 5	1,628	13.296	18.50	373	50.20	1,255	2.04	88.24	86.50	20.99	1.050	0.79	15.80	1.12	0.46	19
Feb. 6	1,709	12.795	20.80	359	51.20	1,350	2.12	87.03	84.06	24.31	1.215	0.78	15.60	1.04	0.69	19
Feb. 7	1,705	12.559	20.20	337	50.90	1,368	2.06	87.12	80.11	19.03	0.952	0.76	15.20	1.34	0.50	19
Feb. 8	1,768	12.712	20.20	320	51.30	1,448	3.40	78.45	73.04	16.86	0.843	0.79	15.80	1.10	0.55	21
Feb. 9	1,562	13.384	20.30	319	52.30	1,243	2.76	83.80	79.80	19.65	0.983	0.75	15.00	1.53	0.43	22
Feb. 10	1,175	14.270	24.30	282	51.40	893	2.24	88.14	86.45	20.75	1.038	1.08	21.60	2.10	0.54	23
Feb. 11	530	11.825	15.40	125	47.20	405	1.81	88.07	94.14	15.34	0.767	0.85	17.00	1.59	0.30	24
Feb. 12	1,430	13.191	19.50	321	49.20	1,109	2.60	84.77	83.73	16.24	0.812	1.14	22.80	2.31	0.52	24
Feb. 13	1,454	11.763	24.10	236	50.70	1,218	3.80	73.18	69.96	19.62	0.981	1.36	27.20	2.66	0.73	25
Feb. 14	1,373	11.404	24.50	255	51.70	1,118	1.96	86.08	84.20	13.93	0.696	1.12	22.40	2.49	0.47	26
Feb. 15	1,535	12.771	20.90	324	47.70	1,211	2.90	82.30	78.83	16.57	0.829	0.99	19.80	2.24	0.42	26
Feb. 16	1,455	10.557	21.00	276	46.80	1,179	1.49	88.71	84.09	24.86	1.243	1.27	25.40	1.94	0.56	27
Feb. 17	1,478	12.778	22.00	322	49.40	1,156	1.67	89.97	84.22	22.05	1.102	1.24	24.80	1.95	0.71	27
Feb. 18	1,470	13.900	18.80	370	44.40	1,100	1.10	94.43	80.40	21.80	1.090	1.74	34.80	1.94	0.60	27
Feb. 19	1,448	12.462	18.00	333	44.80	1,115	0.92	94.56	82.71	21.40	1.070	2.02	40.40	2.02	0.66	27
Feb. 20	1,352	12,954	15.50	426	46.50	1,126	0.90	94.89	98.53	21.56	1.078	2.54	50.20	1.93	0.56	28
Feb. 21	1,779	13.985	19.00	490	47.00	1,289	0.99	94.92	92.56	17.69	0.885	1.24	24.80	1.87	0.59	28
Feb. 22	1,756	13.687	20.90	398	51.30	1,358	2.19	87.75	84.95	20.22	1.011	2.85	57.00	2.29	0.54	29
Feb. 23	1,658	15.350	22.00	412	51.70	1,246	2.24	89.28	83.69	14.97	0.749	1.35	27.00	2.47	0.59	30
Feb. 24	1,769	14.312	24.40	454	48.60	1,315	2.10	89.18	87.15	24.13	1.207	1.05	21.00	2.08	0.46	31
Feb. 25	1,353	13.398	18.10	385	43.60	968	1.01	94.65	92.60	22.41	1.120	1.13	22.60	1.66	0.44	32
Feb. 26	1,662	14,043	17.10	489	43.20	1,173	1.19	94.12	90.51	24.17	1.209	1.17	23.40	1.69	0.45	32
Feb. 27	1,219	15,780	19.00	428	41.30	791	1.69	93.10	91.90	20.85	1.042	1.14	22.80	1.61	0.62	33
Feb. 28	1,794	14.645	21.50	522	42.30	1,272	2.50	87.94	87.22	19.30	0.905	1.26	25.20	1.90	0.68	34
Month	43,557	13.190	19.70	10,212	48.10	33,344	1.94	88.87	85.49	19.33	0.967	1.18	23.60	1.77	0.52	

W.A.S.
T.F.S.
J.B.K.
D.C.J.
J.L.B.
B H D. April 4, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 162.

BUTTE AND SUPERIOR MINING COMPANY

FLOTATION PLANT RECORD — **MARCH, 1917**

DATE	Flotation Plant Feed Dry Tons	Flotation Plant Feed Per Cent Zinc	Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation) Per Cent Zinc	Flot. Concentrates Dry Tons	Flot. Concentrates Per Cent Zinc	Flot. Tailings Dry Tons	Flot. Tailings Per Cent Zinc	Flot. Zinc Recovery Apparent	Flot. Zinc Recovery Estimated	OIL—AMOUNT AND ANALYSIS: Per Ton Ore to Flotation Pounds Added	Per Ton Ore to Flotation Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Middling Treated in Flot.	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
Mar. 1	1 628	14.48	21.60	479	45.40	1 148	1.41	93.16	92.26	19.76	0.99	1.17	23.40	1.64	0.62	35
2	1 781	15.02	24.30	512	47.30	1 269	1.74	91.79	90.56	29.44	1.47	2.76	55.20	2.71	0.68	36
3	1 478	13.15	25.70	346	48.60	1 152	1.66	90.47	86.51	21.66	1.08	1.23	24.60	2.28	0.61	37
4	1 521	12.94	21.30	372	47.30	1 149	1.29	92.56	89.42	17.52	0.87	1.28	25.60	2.01	0.57	38
5	1 523	12.52	23.90	342	50.50	1 181	1.56	90.33	90.61	23.42	1.17	1.28	25.60	1.98	0.62	39
6	1 510	13.18	24.10	375	48.30	1 135	1.30	92.63	91.04	18.72	0.94	1.30	26.00	2.11	0.54	40
7	1 457	13.25	20.40	377	45.20	1 082	1.11	93.[illegible]	88.24	25.28	1.26	1.15	23.00	1.97	0.50	40
8	1 281	11.90	21.70	297	46.70	984	1.17	92.[illegible]	90.99	20.00	1.00	1.29	25.80	2.14	0.63	40
9	1 453	12.18	20.50	331	47.00	1 122	1.52	90.45	87.94	21.90	1.09	1.44	28.80	2.34	0.74	40
10	1 541	13.32	21.40	394	46.20	1 147	1.37	92.46	88.66	20.83	1.04	1.88	37.60	2.86	0.69	40
11	1 421	11.84	21.40	307	48.60	1 114	1.46	90.38	88.66	22.57	1.13	1.52	30.40	2.64	0.58	40
12	1 321	12.20	27.20	267	51.50	934	2.00	86.98	85.31	20.09	1.00	1.20	24.00	2.45	0.66	40
13	1 445	13.60	29.20	327	51.10	1 118	2.47	85.99	85.03	19.20	0.96	1.62	32.40	2.55	0.65	40
14	1 557	13.30	30.00	344	49.30	1 213	2.52	85.48	81.62	24.23	1.21	1.45	29.00	2.66	0.53	40
15	1 703	11.85	22.50	363	47.40	1 340	1.72	88.70	82.78	21.73	[illegible]	1.59	31.80	2.52	0.63	41
16	1 857	11.04	19.80	405	47.00	1 452	1.17	91.68	92.80	20.[illegible]5	1.04	1.35	27.00	2.22	0.74	42
17	1 623	12.31	20.00	392	45.10	1 231	1.00	93.96	88.51	18.81	0.94	1.48	29.60	1.92	0.87	43
18	1 105	11.99	15.70	269	46.40	836	1.32	91.60	94.22	25.71	1.28	1.91	38.20	2.40	1.16	42
19	1 477	12.15	18.90	363	44.00	1 114	1.11	93.22	89.02	21.26	1.06	1.55	31.00	2.71	1.01	44
20	1 549	11.80	24.30	332	47.20	1 217	1.88	87.56	85.73	19.62	0.98	1.47	29.40	2.94	0.91	45
21	1 473	13.84	23.30	365	47.60	1 108	2.61	85.85	85.21	23.74	1.19	1.72	34.40	2.93	1.15	45
22	1 598	11.82	25.80	228	44.90	1 370	6.40	53.48	54.19	23.59	1.17	1.77	35.40	3.09	0.76	46
23	1 476	13.56	19.80	406	41.30	1 070	2.62	86.12	83.78	22.11	1.10	1.85	37.00	2.64	0.55	47
24	1 549	12.78	22.00	345	45.10	1 204	3.15	81.01	78.58	23.59	1.18	1.47	29.40	2.48	0.69	48
25	1 470	12.25	22.00	346	44.30	1 124	2.10	86.98	85.14	21.56	1.08	1.41	28.20	2.83	0.77	49
26	1 451	12.24	29.00	319	48.00	1 132	2.37	84.83	86.20	21.94	1.09	1.49	29.80	2.64	0.67	49
27	1 421	12.52	30.00	300	50.00	1 121	1.75	89.14	84.30	23.54	1.18	1.55	31.00	2.61	0.67	49
28	1 557	13.41	32.70	360	50.60	1 197	2.20	87.39	87.23	22.85	1.14	1.38	27.60	2.41	0.76	49
29	1 706	11.83	29.80	335	50.30	1 371	2.14	85.55	83.50	24.97	1.25	1.41	28.20	2.43	0.58	50
30	1 667	12.16	27.70	824	49.50	1 343	7.67	82.49	79.09	21.66	1.08	1.35	27.00	3.36	0.71	50
31	1 774	11.89	29.70	323	50.70	1 451	3.12	78.60	77.63	21.86	1.09	1.71	34.20	3.36	0.80	50
Month	47 373	12.66	23.42	10 845	47.30	36 449	2.04	87.67	85.60	22.08	1.10	1.52	30.40	2.45	0.71	

W.A.S.
T.F.S.
J.B.K.
D.C.J.
R.H.D.
J.L.B.

April 14th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 163.

BUTTE & SUPERIOR MINING COMPANY

FLOTATION PYRAMID MACHINES

		MACHINE FEED					OIL—AMOUNT AND ANALYSIS						
		Ore To Machines		Concentrates	Tailings	% Zinc Recovery	Per Ton Ore To Machines						
Date	Machine No.	Dry Tons	% Zinc	% Zinc	% Zinc	Apparent	Pounds Added	Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Machines	Pounds Oil per Ton in Ore and Circulating Middling Treated in Machines	Per Cent Oil in Concentrates	Per Cent Oil in Tailings	Oil Used No.
12/29/1916	2	178	14.00	46.00	2.32	87.86	28.74	1.43	No Analysis	———	No Analysis	No Analysis	1 A
12/30/1916	1	108	13.20	47.60	1.35	92.39	33.67	1.68	3.32	66.40	2.57	1.10	2 A
12/30/1916	2	117	13.30	45.40	0.96	94.79	32.85	1.64	1.84	36.80	2.42	0.86	3 A
12/31/1916	1	160	12.20	46.20	2.38	84.86	24.13	1.20	3.27	65.40	2.67	1.77	4 A
12/31/1916	2	115	11.00	45.40	1.10	92.23	35.72	1.78	1.24	24.80	1.40	2.26	5 A
1/1/1917	1	153	11.10	42.90	0.99	93.23	28.69	1.43	1.54	30.80	2.12	1.11	4 A
1/1/1917	2	93	12.80	44.60	0.50	97 18	45.19	2 26	1.01	20.20	3.13	1.11	5 A
1/1/1917	8	76	13.10	42.70	1.51	91.72	63.03	3.15	2.94	58.80	2.62	2.72	6 A
1/2/1917	1	160	13.80	47.70	2.20	88.05	27.60	1.38	1.59	31.80	1.78	1.49	7 A
1/2/1917	2	140	14.20	46.50	1.95	90.04	29.90	1.49	2.66	52.20	1.84	2.47	5 A
1/2/1917	8	210	15.00	43.40	2.96	86.14	22.00	1.10	1.94	38.80	1.53	1.75	8 A
1/3/1917	1	167	13.10	44.20	1.60	91.10	32.13	1.60	2.89	57.80	1.61	0.35	9 A
1/3/1917	2	135	15.50	42.80	3.35	84 29	24.61	1.23	2.37	47.40	1.38	1.30	10 A
1/3/1917	8	117	14.10	44.50	1.44	92 79	41.30	2.06	1.79	35.80	2.17	1.60	11 A
1/4/1917	1	120	14.80	45.70	2.25	89.19	34.03	1.70	2.50	50.00	1.34	0.82	5 A
1/4/1917	2	130	11.00	41.90	0.91	93.76	24.98	1.25	2.62	52.40	1.56	2.17	12 A
1/5/1917	1	162	12.20	42.00	1.40	91.58	24.38	1.22	1.31	26.20	2.39	0.91	5 A
1/5/1917	2	173	14.40	43.50	2.96	85.25	23.22	1.16	3.24	64.80	2.17	0.94	13 A
1/5/1917	8	132	9.50	48.80	0.90	92 23	36.96	1.84	2.11	42.20	2.08	0.54	14 A
1/6/1917	1	213	14.90	48.80	2.21	89.21	19.44	0.97	3.26	65.20	1.47	0.66	5 A
1/6/1917	2	149	13.90	47.00	1.45	92.42	27.41	1.37	1.93	38.60	1.87	1.39	13 A
1/6/1917	8	128	8.40	46.20	0.80	92.07	34.32	1.71	1.55	31.00	2.56	0.55	14 A
1/7/1917	1	198	12.40	36.30	1.54	91.46	22.51	1.12	1.25	25.00	2.12	0.51	15 A
1/7/1917	2	240	15.70	50.10	1.56	92.96	16.19	0.81	3.10	62.00	1.40	0.83	16 A
1/7/1917	8	54	8.10	47.70	0.74	92.30	35.74	1.78	2.13	42.60	2.19	1.40	14 A
1/8/1917	1	103	11.70	44.70	1.26	91.82	12.97	0.65	1.82	36.40	1.66	0.63	14 A
1/8/1917	2	89	15.10	45.80	1.42	93.49	21.83	1.09	4.39	87.80	1.24	1.45	14 A

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By d. H. WALKER, Deputy.

5199-5200-02 Defendant's Exhibit No. 164.

Butte and Superior Mining Company.

Below is a statement showing the percentages of oils in the various mixtures used on the three pyramid machines, while running them on experimental tests.

Mixture No.	Kerosene.	Jones crude.	No. 1 creosote.	No. 2 creosote.	Fuel.	Pine.	No. 4 Barrett.	Tar.	Paraffine base.
1 A	54	..	..	46	..	..	..	..	..
2 A	..	98	..	..	..	2	..	..	..
3 A	82	..	..	18	..	..	..	..	..
4 A	30	70	..	..	..	..	..	..	..
5 A	77	..	..	23	..	..	..	..	..
6 A	67	..	..	7	..	..	..	26	..
7 A	30	65	..	5	..	..	..	..	..
8 A	77	..	..	8	..	..	..	15	..
9 A	22	74	..	4	..	..	..	..	..
10 A	91	..	..	9	..	..	..	..	..
11 A	..	97	..	3	..	..	..	..	..
12 A	..	87	..	..	..	13	..	..	..
13 A	85	..	..	3	..	..	..	12	..
14 A	..	..	100	..	..	..	..	..	..
15 A	8	..	90	2	..	..	..	..	..
16 A	1	..	97	..	..	..	..	2	..

Butte, Montana, April 17, 1917.

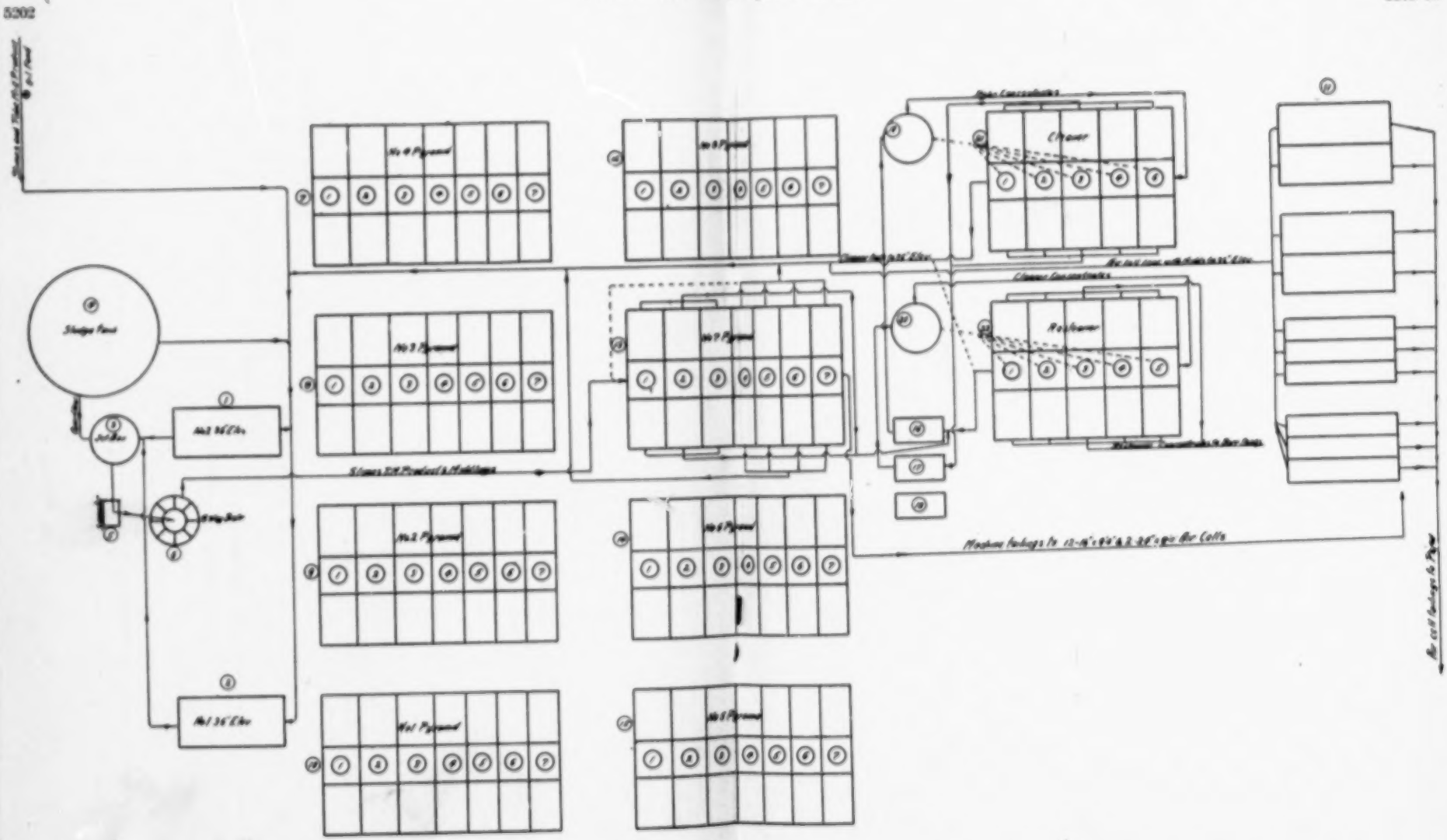
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 165.

Flow Sheet Butte & Superior Plant.

5202

5203-04



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5205 Defendant's Exhibit No. 166.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Basin, Mont.

Expense account for July, 1911, @ $5.00 per day..	155 00	
One third payment on Test Machine.....	10 00	
		165 00

Butte, Montana. —— —, 191–.

Received from Butte & Superior Copper Co., Ltd., One hundred sixty five and no/100 Dollars in full payment of the above account.

Signature: JAMES M. HYDE,
Per —— ——.

$165/00.

Please sign original and duplicate and return promptly.

Correct:
A. J. F., *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) Original. Voucher No. 3409. Amount $165.00. Check No. —. Date Paid, —— —, ——. To J. M. Hyde. Month July, 1911. Distribution. Extraordinary Expense, $165.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5206 Defendant's Exhibit No 167.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Basin, Mont.

Expenses, month of August, 1911, 31 das. @$5.00 per day. 155 00

Butte, Montana, —— —, 1911.

Received from Butte & Superior Copper Co., Ltd., one hundred fifty-five & no/100 Dollars in full payment of the above account.

Signature: JAMES M. HYDE,
Per —— ——.

$155.00.

Please sign original and duplicate and return promptly.

Correct:
A. J. F., *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) 8. Original. Voucher No. 3495. Amount $155.00. Check No. 2415. Date Paid 8/8/11. To J. M. Hyde. Month August, 1911. Distribution. Concentrating, $155.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk. by H. H. Walker, Deputy.

5207 Defendant's Exhibit No. 168.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Basin, Mont.

First payment on account of Hyde plant installation..... 150.00

Butte, Montana, Sept. 22, 1911.

Received from Butte & Superior Copper Co., Ltd., one hundred fifty and no/100 Dollars in full payment of the above account.

Signature: J. M. HYDE.

$150.00.

Please sign original and duplicate and return promptly.

Correct:

A. J. F., *Clerk.*

Approved:

M. W. ATWATER,

Superintendent.

(Endorsement:) 37. Original. Voucher No. 3508. Amount, $150.00. Check No. 2444. Date Paid 9/21/'11. To J. M. Hyde. Month September, 1911. Distribution. Basin Concentrator Equipment, 150.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5208 Defendant's Exhibit No. 169.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Basin, Mont.

Second payment on account of Hyde plant installation..... 150.00

Butte, Montana, —— —, 19—.

Received from Butte & Superior Copper Co., Ltd, one hundred fifty and no/100 Dollars in full payment of the above account.

Signature: J. M. HYDE,
Per —— ——.

$150.00.

Please sign original and duplicate and return promptly.

Correct:
A. J. F., *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) 47. Original. Voucher No. 3519. Amount $150.00. Check No. 2460. Date Paid 9/25/'11. To J. M. Hyde. Month Sept., 1911. Distribution. Basin Concentrator Equipment 150.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5209 Defendant's Exhibit No. 170.

Original.

Butte & Superior Copper Company (Limited)

To J. M. Hyde, Dr.

Address, Basin, Mont.

Expense A/C at Basin at $5.00 per day for the month of September $150.00

Butte, Montana, Oct. 26, 1911.

Received from Butte & Superior Copper Co., Ltd., One hundred fifty & no/100 Dollars in Full payment of the above account.

Signature: J. M. HYDE,
Per —— ——.

$150.00.

Please sign original and duplicate and return promptly.

Correct:
A. J. L., *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) 68. Original. Voucher No. 3584. Amount $150.00. Check No. 2534. Date Paid Oct. 20, 1911. To J. M. Hyde. Month, September, 1911. Distribution. Concentrating $150.00.

(In Pencil.)

Get after Scott (Purchasing Dept.) get 3/8x1¾ Elev. Bolts instead of whatever is ordered.
M. W. Atwater, Hotel Samuels, Wallace, Idaho.
Where are derrick irons? Are they shipped?
When? Where?
If not shipped cut out pulleys (all).

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5210 Defendant's Exhibit No. 171.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Auditorium Annex.

To third payment of Hyde Plant installation..... 5,000.00

Butte, Montana, Nov. 9, 1911.

Received from Butte & Superior Copper Co., Ltd., Five thousand and no/100 Dollars in full payment of the above account.

Signature: J. M. HYDE,
Per —— ——.

$5,000.00.

Please sign original and duplicate and return promptly.

Correct:
6. —— ——, *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) Original. Voucher No. 3610. Amount $5000.00. Check No. 2553. Date Paid 10/26/'11. To J. M. Hyde. Month, Oct., 1911. Distribution. Basin Concentrator Equipment 5000.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5211 Defendant's Exhibit No. 172.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Basin, Mont.

To expense account for October, 1911, 26 das. @ $5.00 per day. 130.00

Butte, Montana, Nov. 9, 1911.

Received from Butte & Superior Copper Co., Ltd., One hundred thirty and no/100 Dollars in full payment of the above account.

Signature: J. M. HYDE,
Per —— ——.

$130.00.

Please sign original and duplicate and return promptly.

Correct:
—— ——, *Clerk.*
Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) 86. Original. Voucher No. 3609. Amount $130.00. Check No. 2552. Date Paid 10/26/'11. To J. M. Hyde. Month, Oct., 1911. Distribution. Concentrating 130.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5212 Defendant's Exhibit No. 173.

(Page 1.)

Expense Account.

Chicago Trip, J. M. Hyde.

Butte to St. Paul (ticket, Pullman, etc.)	$42.50
Meals on train, porter, etc.	5.75
St. Paul to Chicago	10.50
Carriage in Chicago	4.00
Express charges on Test Machine	8.00
Deposit on motor (to be collected by Scott and deducted from his expense acc't)	20.00
Carriage	3.50
Hotel	27.65
Chicago to Duluth	11.80
Duluth to Butte	37.85
Hotel at Duluth	3.00
Meals, Carriage, etc., Chicago & Train	38.30
Trip to Basin and return	3.80
Meals and incidentals at Butte	4.50
	$230.15

5213 (Page 2.)

Original.

Butte & Superior Copper Company (Limited).

To James M. Hyde, Dr.

Address, ——.

Account of expense trip Butte to Chicago and return, as per statement attached $230.15 $230.15

Butte, Montana, —— —, 19—.

Received from Butte & Superior Copper Co., Ltd., Two hundred thirty & 15/100 Dollars in Full payment of the above account.

Signature: —— ——,
Per —— ——.

$230.15.

Please sign original and duplicate and return promptly.

Correct:
A. J. F., *Clerk.*

Approved:
M. W. ATWATER,
Superintendent.

(Endorsement:) 72. Original. Voucher No. 3764. Amount $230.15. Check No. 2736. Date Paid Dec. 20, 1911. To James M. Hyde. Month, November, 1911. Distribution. Extraordinary ex. $230.15.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5214 Defendant's Exhibit No. 174.

Original.

Ent. J. 46.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Butte, Mont.

Expense Account dated Jan. 31, 1912.....	$383.65	
" " " Mar. 30, 1912.....	585.82	
	$969.47	
Less: Advance as Voucher 3998.....	600.00	
		$369.47

Butte, Montana, —— —, 19—.

Received from Butte & Superior Copper Co., Ltd., Three Hundred Sixty-nine & 47/100 Dollars in Full payment of the above account.

Signature: JAMES M. HYDE,
Per —— ——.

$369.47.

Please sign original and duplicate and return promptly.

Correct:
C. M. E., *Auditor.*

Approved:
M. W. A.,
Superintendent.

(Endorsement:) 29. Original. Voucher No. 4153. Amount $369.47. Check No. 3153. Date Paid Mar. 30, 1912. To J. M. Hyde. Month March. Distribution. Extraordinary Expense $369.47.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5215 Defendant's Exhibit No. 175.

Original.

Butte & Superior Copper Company (Limited).

To J. M. Hyde, Dr.

Address, Butte, Montana.

Advance on Expenses..... $400.00

Butte, Montana, —— —, 19—.

Received from Butte & Superior Copper Co., Ltd., Four Hundred Dollars in Full payment of the above account.

Signature: JAMES M. HYDE,
Per —— ——.

$400.00.

Please sign original and duplicate and return promptly.

Correct:
C. M. E., *Auditor.*

Approved:
M. W. A.,
Superintendent.

Endorsed on back: 30. Original. Voucher No. 4154. Amount $400.00. Check No. 3154. Date Paid Apr. 17, 1912. To J. M. Hyde. Month April. Distribution. Accts. Payable $400.00.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5216 Defendant's Exhibit No. 176.

Butte & Superior Copper Company, Limited.

No. 4550.

Butte, Mont., July 8, 1912.

Pay to the order of J. M. Hyde, $200.00, Two Hundred and No-100 Dollars.

BUTTE & SUPERIOR C. CO., LTD.,
(Signed) C. M. EVERETT.

Special.

To the First National Bank, Butte, Mont.

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check." (Signed) James M. Hyde. Paid 7-9-12. 4550.

Butte & Superior Copper Company, Limited.

Voucher.

Butte, Mont., July 8, 1912.

Payable to J. M. Hyde, $200.00, Two Hundred and No-100 Dollars.

Approved for payment.
(Signed) C. M. EVERETT.

Details of Voucher.

4550.

Expense Account 200.00

Distribution Hyde Process Patent Right. No. 4550.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5217 Defendant's Exhibit No. 177.

Butte & Superior Copper Company, Limited.

No. 5333.

Butte, Montana, Nov. 21, 1912.

Pay to the Order of James M. Hyde, 602.50, Six Hundred Two and 50-100 Dollars.

BUTTE & SUPERIOR COPPER COMPANY, LTD.,
By C. M. EVERETT.

Special.

To the First National Bank, Butte, Montana.

Stamped across face of check: "Paid, Dec. 10, 1912. The First National Bank of Butte, Butte, Montana. P."

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check." (Signed) James M. Hyde. M. W. A.

The amount advanced Mr. Hyde is $600.00.

April 17	400.00	on a-c.
July 8	200.00	"
	600.00	

Paid.

Paul:

Enter Hyde account for 602.50, balance due on trips to Washington and England. Details on attached statements, and pay at once.
M. W. A.

5218 Paul:

Please check amounts advanced Hyde and return.
M. W. A.

Hayden, Stone & Co., Bankers,

New York-Boston.

J. M. H.—M. New York, October 23, 1912.

Mr. M. W. Atwater, Butte & Superior Copper Co., Butte, Montana.

My Dear Max: In looking over my records I find that I did not present an account of the expenses of my trip to Washington this

Spring; my memory is that you advanced me $400 for expenses for that trip and $200 on the London one, of course, you have a record of this. I enclose herewith an account, also the account of my trip from Butte to London and return to New York.

I have trimmed these expense accounts down so that they do not really represent the total necessary cost of my travels.

I shall probably be in New York for two weeks more as the opposition is rather slow in getting in their evidence, but I hope that by the end of that time everything will be complete in the matter of the present suit with the exception of the presentation of
5219 the case in court, and possibly some consultation between Mr. Scott and myself before the matter comes to trial.

You may address me care of Hayden, Stone & Co., 25 Broad Street, New York City.

Our friends, the enemy, are not at all happy nowadays and I will not be surprised if they make some overtures looking to a withdrawal of the suit. This is what they have done in other cases where they had a much better showing than they had with us.

Hoping that all is well with you and trusting that you will at any time call upon me when you feel that my services are necessary, I remain,

Yours very truly,
(Signed) JAMES M. HYDE.

(Encl.)

Expense Account of James M. Hyde, Trip to Washington on Patent Suit, Leaving Butte April 17, 1912.

Room for Byrnes at Napton	$9.00
Materials	5.00
Gas	1.00
Ticket and Pullman, Butte to Washington	68.65
Taxi and express	2.50
Meals and porters	10.75
Hotel in Washington 23 days at $6	138.00
5220	
Telegrams, materials, etc	18.50
Ticket & Pullman to Butte	68.65
Meals, etc., to Butte	12.00
	$334.05

Expense Account of James M. Hyde, Trip to London on Patent Suit, Leaving Butte July 18, 1912.

Butte to New York, ticket & Pullman	$75.70
Meals and porter to New York	18.00
Hotel, taxi, etc., in New York	9.25
Passage to London S-S Geo. Washington	151.00
Steamer expenses	10.00
London July 21-Sept. 5th, 45 days at $10	460.00
Telegrams, messenger, etc	24.50
Passage to New York, S-S Minnetonka	110.00
Expenses on steamer	10.00
	$868.45

Butte and Superior Copper Company, Limited.

Voucher.

Butte, Mont., Nov. 21, 1912.

Payable to James M. Hyde, $602.50, six hundred two and 50-100 dollars.

Approved for payment.

(Signed) C. M. EVERETT.

5221 *Details of Voucher.*

Expenses trip to Washington Apr. 17	334.05	
" " " London July 18-12	868.45	
Total	1,202.50	
Less.		
Advance Apr. 17th, 1912	400.00	
" July 8th, 1912	200.00	
	600.00	
Net balance	602.50	602.50

Distribution. Account payable, 602.50. General office, No. 5333.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5222 Defendant's Exhibit No. 178.

Butte & Superior Copper Company, Limited.

New York Office, 25 Broad Street.

July 31, 1913.

Mr. J. L. Bruce, Manager, Butte & Superior Copper Company, Ltd., Butte, Montana.

DEAR SIR: I am enclosing herewith copy of a telegram received today from James M. Hyde, which I thought you would be interested in seeing.

Yours very truly,
(Signed) N. B. MACKELVIE.

N. B. M./S.

Enclosure.

Copy.

Berkeley, California, July 30, 1913.

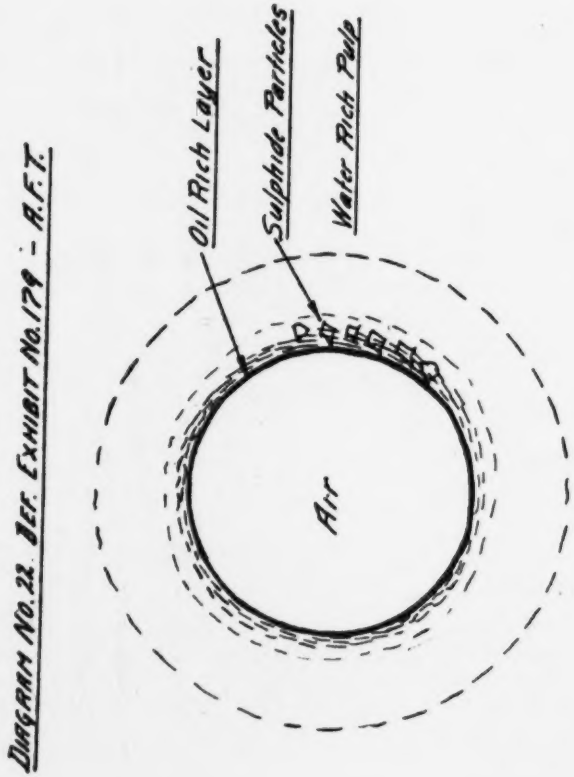
N. B. MacKelvie:

Have received word of decision from Kremer but no details. I take for granted that appeal will be filed. Am at your service for any conferences the occasion may require. Will expect matters under discussion to be held in abeyance until new and unexpected situation is taken care of.

(Signed) JAMES M. HYDE.

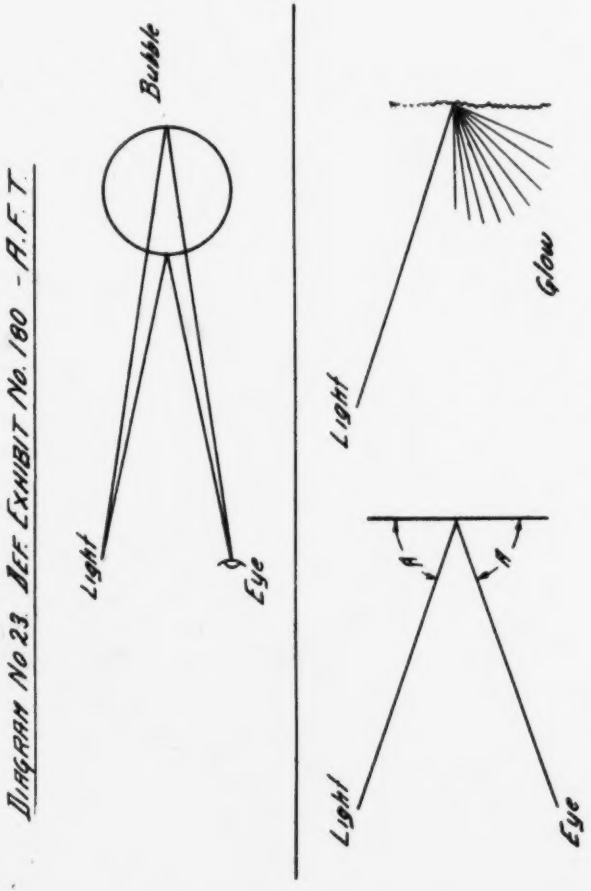
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5223



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5224



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 181.

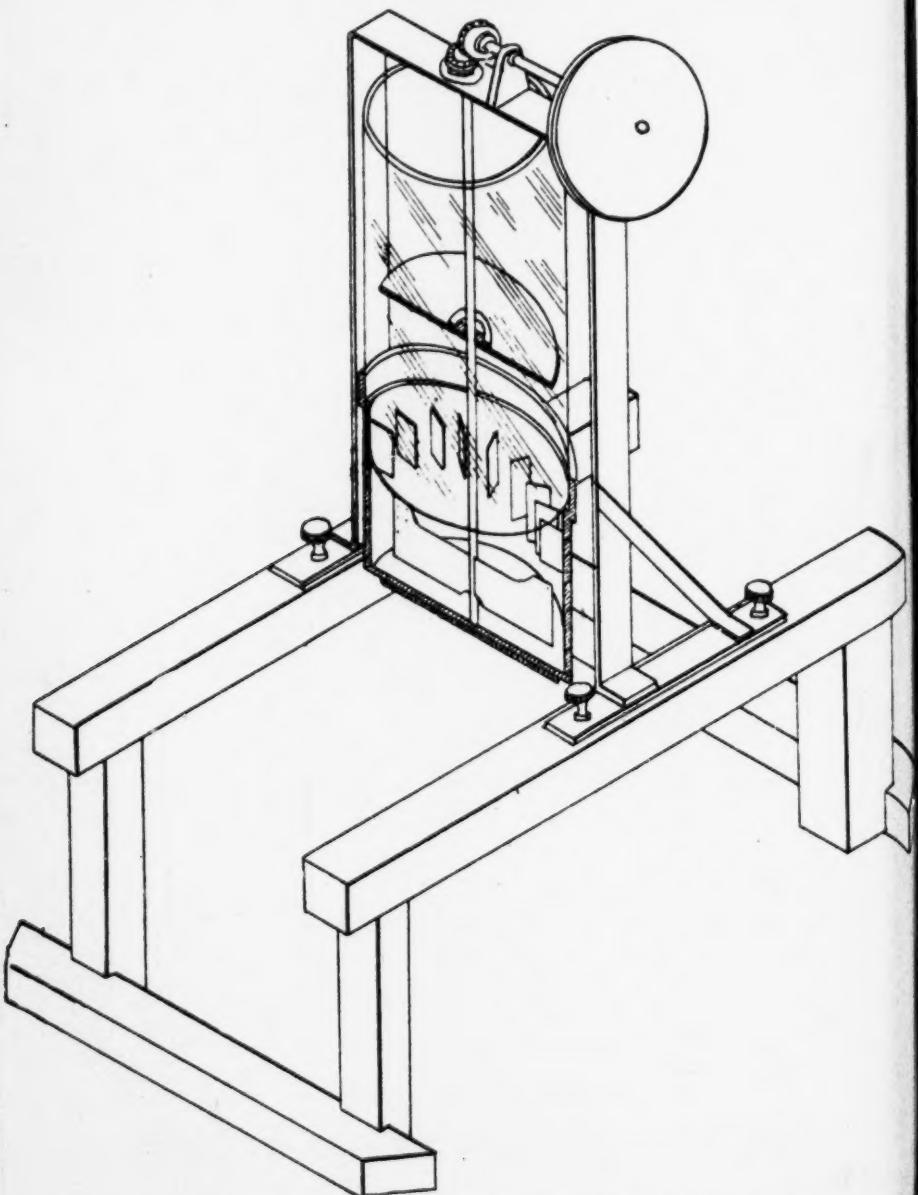
Lantern Slides—Physical Exhibit.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

182—Rec.

5225

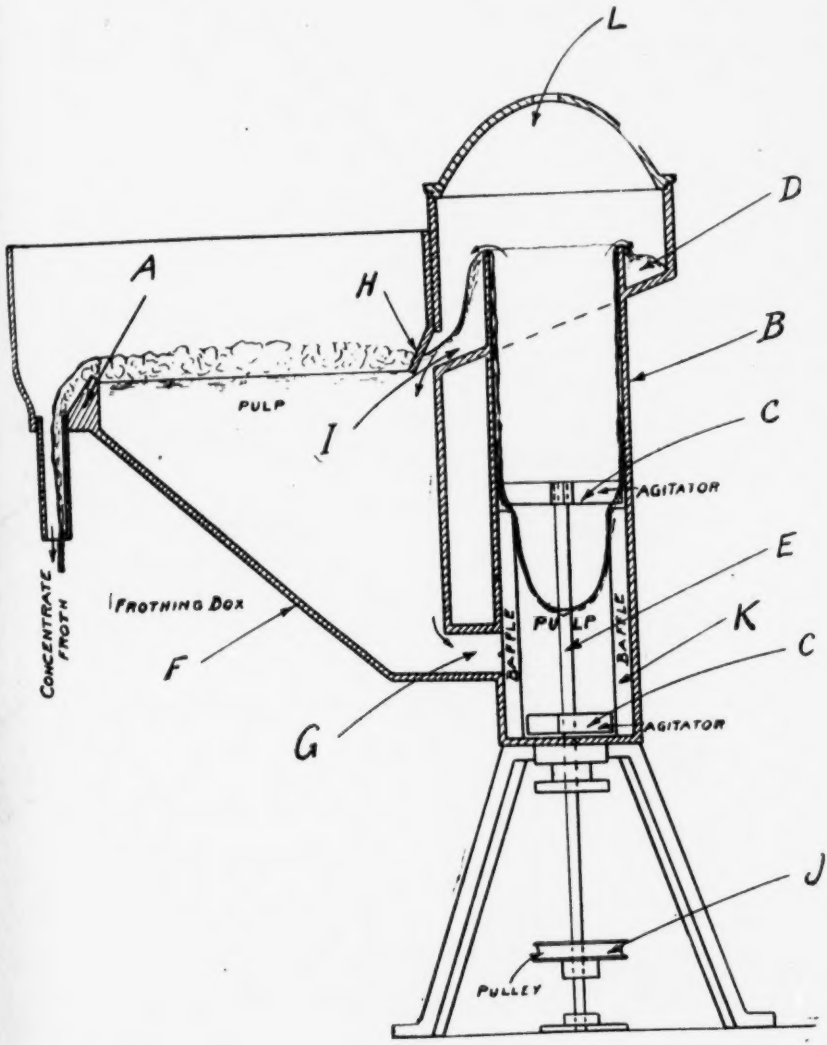
Defendant's Exhibit No. 182.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5226

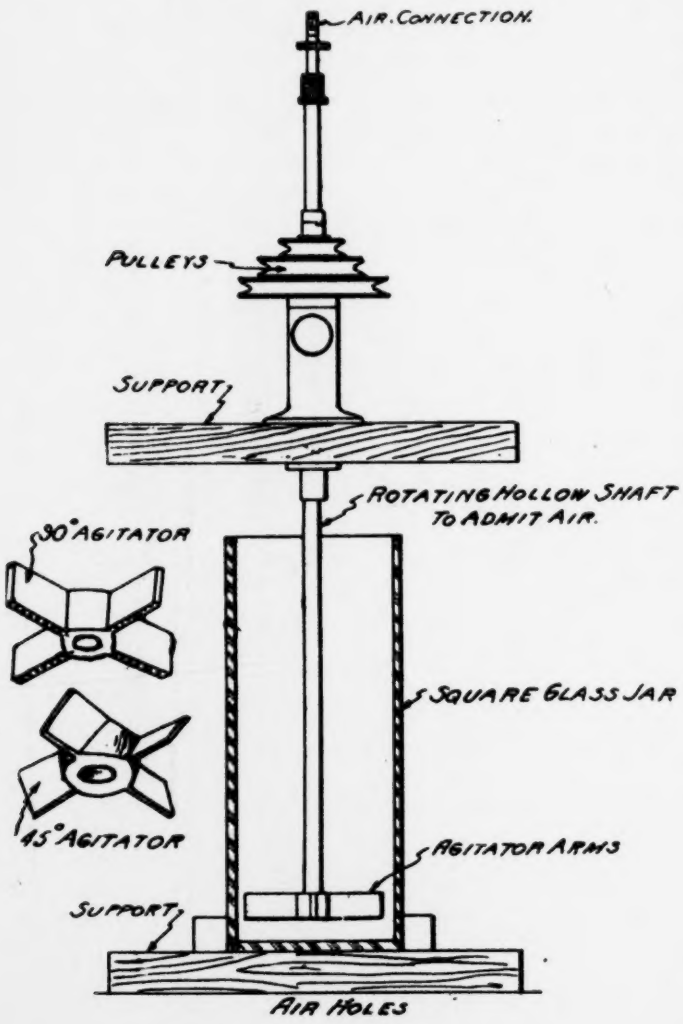
Defendant's Exhibit No. 183.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5227

Defendant's Exhibit No. 184.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5228 Defendant's Exhibit No. 185.

Janney Machine—Physical Exhibit.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 186.

Cataract Machine—Physical Exhibit.

Filed August 9, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 187.

Fryer Hill Machine—Physical Exhibit.

Filed August 9, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 188.

Square Glass Jar Machine—Physical Exhibit.

Filed August 9, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 189.

Cone Gabbett, Including Upcast—Physical Exhibit.

Filed August 9, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Ore Flotation*

BY WILDER D. BANCROFT

When discussing the theory of ore flotation, people are apt to lay great stress upon surface tension in general and upon contact angles in particular. While this is entirely legitimate, it seems undesirable, because we cannot measure a contact angle with any accuracy and because the actual existence of a contact angle is a matter of doubt.[1] The problem of ore flotation is a very simple one or a very complex one, depending on our point of view. It has been customary to consider it as a very difficult problem, but the other attitude rather appeals to me. There is nothing strange to us in the fact that water wets glass and that mercury does not. We also know that water does not wet greasy glass readily. If one wishes to say that these facts are mysterious, I concede it willingly, because everything becomes mysterious if one follows it back far enough. All I claim is that this is no more mysterious than anything else, and that if we start with these bits of every-day knowledge as given, there are no other serious difficulties in connection with ore flotation. Ore flotation is not a unique phenomenon, it is merely a special case under the broad heading of emulsions.

If a liquid wets a solid, it is adsorbed by the solid, forming a liquid film on the surface of the latter and displacing the air film that was there. If a liquid is not adsorbed by the solid, it does not wet the solid. The formation of a liquid film over the surface of a wetted solid accounts for the experimental fact that the rise of a liquid in a capillary tube is independent of the nature of the walls of the tube. This has always seemed a very improbable state of things, and one that could be justified only by the fact that it was so. It becomes quite simple, however, the moment we consider that the rising liquid does not come in contact with the walls of the capillary tube at all. We are really dealing with the rise of liquid in a liquid tube, and it makes no difference what material is used to support the walls of the liquid tube. That this is the real explanation may be seen from the fact that concordant results are not obtained when a liquid is allowed to rise in a dry tube. To get good results it is important to immerse the tube in the liquid and then to raise the tube.

Since the wetting of a solid is a case of selective adsorption, we should expect that one liquid would wet a given solid more readily than another liquid does, and consequently that the first liquid would displace the second from contact with the solid. No systematic study of this phenomenon seems to have been made, but we know that alcohol will displace oil in contact with metal[2] and that water will displace kerosene in contact with quartz.[3] If we shake a finely divided solid with water and a liquid which is not completely miscible with water, an oil for instance, we can distinguish three cases. The solid is wetted entirely by water, in which case it stays in the water phase and settles to the bottom of it. The solid is wetted entirely by the oil, in which case it stays in the oil phase and sinks to the bottom of it. The solid is wetted simultaneously by oil and water, in which case it passes into the interface separating the two liquids. If the oil is less dense than the water, as is usually the case, it is a little difficult to distinguish between the last two cases. If the non-aqueous liquid is denser than water, chloroform or carbon tetrachloride for instance, it is difficult to distinguish between the first and third cases. The particles will float if the mean density of solid plus adherent oil film is less than that of the water. They may also float if the action of gravity is not sufficient to overcome the surface tension of the water and thus to pull them through the surface. The maximum weight of substances which can be floated can be calculated from the surface tension under ideal conditions. This calculation applies only when the solid passes into the upper liquid, and does not hold for the case where the solid passes into the interface.

Since we are dealing with selective adsorption, we should expect to find that certain substances would float readily, some others less well, and still others not at all, both the nature of the solid and of the liquid having an effect. This is the case experimentally. Hofmann found that lead iodide, silver iodide, mercuric iodide, mercuric sulphide, and mercuric oxide were floated by ether, butyl alcohol, benzene, kerosene, and amyl alcohol. Copper sulphide, lead sulphide and calcium carbonate were floated only partially by ether, but completely by the other liquids; while zinc sulphide and tin sulphide did not float readily in ether or butyl alcohol, and calcium sulphate was not floated by any of the liquids.

An interesting experiment, which has been done in my laboratory,[4] is to shake copper powder or aluminium powder with kerosene and water. The metallic powder goes into the kerosene and into the interface, producing an effect of molten copper or molten aluminium, as the case may be. When the bottle is allowed to stand after having been shaken, the metallic powder in the interface creeps up the side of the bottle above the surface of the liquid, rising higher if a little alcohol has been added. I have seen an apparently coherent metallic film rise 2 or 3 in. above the surface of the upper liquid phase. If too much copper or aluminium be added, the kerosene cannot hold all of it up and a portion falls to the bottom of the flask, carrying crops of kerosene with it. If the mixture be poured out on a piece of wood, the copper spreads over the surface of the wood just as it did over the surface of the glass. This experiment illustrates the principle involved in all bronzing liquids. A bronzing liquid consists of a volatile liquid which will hold up the metal, and some substance which will keep the metallic powder from rubbing off too readily after it has been applied. The aluminium and copper powders on the market are coated with stearin. This makes them difficult to wet with water, but special experiments have shown that the behavior of copper or aluminium with kerosene is qualitatively the same whether the stearin coating is removed with ether or not.

Similar results can be obtained with colloidal solutions. Isobutyl alcohol[5] was added to a colloidal gold solution obtained by reducing gold chloride with carbon monoxide. When the two liquids are shaken, the gold forms a thin film at the interface. This film is violet blue to blue green by transmitted light and golden by reflected light. A thin water film forms between the isobutyl alcohol and the glass, and the gold concentrates in the dineric interface thus formed, making the alcohol appear uniformly gold-plated. With ether the gold film rises high above the level of the two liquids. With carbon bisulphide the adherent film of gold appears blue. When the carbon bisulphide is broken into drops by shaking, each drop appears blue. When a blue gold was obtained by reducing gold chloride with phosphorus dissolved in ether, the gold went into the dineric interface. When a brownish-red gold was obtained in this way, it remained in the water phase and showed no tendency to pass into the interface. This difference is undoubtedly due to an adsorption of some

*A paper read at the joint meeting of the New York sections of the American Institute of Mining Engineers and the American Electrochemical Society on May 12, 1916.

[1] Rayleigh, Scientific Papers, 3, 364 (1904).

[2] Pockels, Wied. Ann. 67, 669 (1899).

[3] Bancroft, Trans. Am. Electrochem. Soc. 23, 294 (1913).

[4] Bancroft, Kolloidchemie, 11, 225 (1913).

thing at the surface of the gold, because Reinders found that 0.005 per cent gum arabic prevents colloidal gold from passing into the ether water interface. With carbon tetrachloride, carbon bisulphide, or benzene, the gold goes into the interface as before, but the gum arabic prevents its changing from red to blue.

Colloidal arsenic sulphide goes into the dineric interface with amyl alcohol or isobutyl alcohol, but stays in the water phase when carbon tetrachloride, benzene or ether is the second liquid. India ink goes completely into the interface with amyl alcohol, carbon tetrachloride, or benzene; it goes partly into the interface with isobutyl alcohol, and stays entirely in the water phase when ether is the second liquid.

Winkelblech[1] has shown that mere traces of gelatine in water can be detected by shaking with organic liquids, the gelatine concentrating at the interface to form a film. "A heavy precipitate was obtained when 10 c.c. of a solution containing 0.234 g. gelatine per liter was shaken with benzene. Precipitates were also obtained when the gelatine solution was diluted tenfold, twenty-fold and even forty-fold, provided 10 c.c. solution were taken for the test. At the highest dilution the concentration of the gelatine was 0.06 g. per liter, and there were consequently 0.03 mg. in the 10 c.c. taken for the test. This seemed to be about the limit at which a precipitation could be detected definitely. . . . Some other colloids behave like the glue colloid (glutin), and can be shaken out of their solutions. Other hydrocarbons are also effective, so that the phenomenon seems to be a general one. Precipitation was obtained with albumin, water-soluble starch and soap, as well as with resin dissolved in very dilute caustic soda. The colloids grouped as mucin can be precipitated from urine and the proteins from beer. It is worth noting that tannin can be precipitated but not gallic acid.

"The hydrocarbons which can be used are: kerosene, liquid paraffin, benzene, chloroform, and carbon bisulphide [in addition to benzene]. The result varies from case to case. With the hydrocarbons which are lighter than water, the precipitate floats on the water; with the denser hydrocarbon the precipitate is below the water layer The emulsions which form seem to have very nearly the same density as the organic liquid used. It is not possible to get the precipitation with all liquids which are non-miscible or slightly miscible with water. Experiments with ether were entirely unsuccessful.

"As a complement to the action of hydrocarbons on aqueous colloidal solutions it was found that fats dissolved in hydrocarbons or similar liquids can be precipitated in the surface film by shaking with water. Precipitations were obtained with butter, olive oil, lanolin, and vaseline. It was also found that the emulsions of heavy hydrocarbons or carbon bisulphide with the fats of low specific gravity also accumulate below the water layer, only a small portion being carried to the surface by adhering air bubbles. When water is used for shaking out, the precipitation is very slight. With a slightly alkaline solution such as dilute lime water, heavy voluminous precipitates were obtained while a transparent layer of fat is obtained when a slightly acid solution is used. With concentrated alkali or acid solutions, viscous emulsions are obtained which hold fast considerable amounts of solution."

Winkelblech patented the use of such organic liquids as kerosene for clearing sewage by shaking out the colloidal oxidizable matter. The method was not a success commercially, because less than 40 per cent of the oxidizable matter was removed.[2]

Briggs[3] has shown that sodium oleate is removed from solutions of different strengths during the process o emulsifying benzene, and that the amount of this re moval depends upon the strength of the soap solutio and the specific surface of the benzene phase. Rayleigh has observed an interesting case in which dust goes int the water layer. "In the course of some experiment last year, in illustration of Sir George Stokes' theor of ternary mixtures, I had prepared an association[4] o water, alcohol, and ether, in which the quantity of alco hol was so adjusted that the tendency to divide into tw parts was almost lost. As it was, division took plac after shaking into two nearly equal parts, and thes parts were of almost identical composition. On placin the bottle containing the liquids in the concentrate light from an arc lamp, I was struck with the contras between the appearance of the two parts. The lower more aqueous, layer was charged with motes, while th upper, more ethereal, layer was almost perfectly fre from them. Some years ago I had attempted the elimi nation of motes by repeated distillation of liquid i vacuum, conducted without actual ebullition, but I ha never witnessed as the result of this process anythin so clear as the ethereal mixture above described.

"The observation with the ternary association, whic happened to be the first examined, is interesting, be cause the approximate equality of the liquids suggest that the explanation has nothing directly to do with gravitation. But the presence of the alcohol is no necessary. Ether and water alone shaken together ex hibit the same phenomenon. It would appear that whe the two liquids are mixed together in a finely divide condition, the motes attach themselves by preferenc to the more aqueous one and thus when separation int two distinct layers follows, the motes are all to be foun below." . . .

"I have lately endeavored to obtain some confirmatio of the views above expressed by the use of other liquids It would evidently be satisfactory to exhibit the selec tion of motes by the upper, instead of by the lower, layer Experiments with bisulphide of carbon and water, an also associations of these two bodies with alcohol, whic acts as a solvent to both, gave no definite result, per haps in consequence of a tendency to the formation of solid pellicle at the common surfaces. But with chloro form and water, and with associations of chloroform water and acetic acid (acting as a common solvent) th experiment succeeded. The motes were always collecte in the *upper*, more aqueous, layer, even when the com position of the two layers into which the liquid sepa rated was so nearly the same that a few additional drop of acetic acid sufficed to prevent separation altogether."[5]

The reverse case appears to occur with white lead. "J Cruickshank Smith" says: "During recent years th practice has been adopted, largely among white-lead cor roders who grind their own white lead in oil, of doing away with the final drying of the white lead pulp as i comes from the washing process, and grinding or beat ing up the pulp (exhausted of water until the proportio of the latter does not exceed about 20 per cent) with suitable quantity of refined linseed oil. This proces depends on the greater surface attraction which white lead particles offer to linseed oil than to water. I enables considerable economies to be effected in th manufacture of ground white lead, and it eliminate risk of lead poisoning during one of the most dangerou parts of the white lead manufacturing process." No

[1] Zeit. angew. Chem. 19, 1953 (1906).
[2] Zeit. angew. Chem. 20, 883 (1907).
[3] Scientific Papers, 3, 569 (1902).
[4] "Association is here employed as a general term denoting th juxtaposition of two or more fluids. Whether the result is a mixture depends upon circumstances.
[5] "The clearness of the upper layer, after a mixture of ether an alcohol has been shaken up with dust, had already been observe and explained, much as above, by Barus, Amer. Jour. Sci. (3) 37 122 (1889).
[6] "The Manufacture of Paint, 33 (1915).

enough oil is added to float the white lead and consequently the white lead carries the oil down with it," leaving the water as upper phase.

That the adhesion between the solid and the liquid may be very marked is shown by the behavior of the so-called water wings. These consist of a closely woven fabric readily permeable to air when dry. When thoroughly wetted, the film of water is strong enough to permit of the wings being blown up enough to float a person with ease.— Though I know of no direct experiments on the subject, it seems probable that the gas pressure in some sandstone anticlines may result from the oil being displaced by water, which would wet the porous rock more readily than does the oil.

In many of the cases where oil flotation has been employed we have a sulphide ore, which is much more readily wetted by oil than by water, in presence of a siliceous gangue, which is much more readily wetted by water than by oil. Consequently the gangue tends to stay in the water phase while the ore is carried up by the oil. The use of an acid solution is natural, because oil adsorbs hydroxyl ions,[9] and these latter cut down the adsorption of the solid. Nagel[10] found that when precipitated chromic oxide is shaken with water and benzene, it goes into the dineric interface, but is precipitated from it by addition of caustic alkali. Zinc sulphide is also precipitated from the dineric interface of kerosene and water by addition of alkali. I am aware that modern flotation practice is tending to the use of neutral or slightly alkaline solutions, but in such cases air plays an important part, and the use of mixed oils may introduce a new set of factors. It must also be remembered that acid in ore flotation does not act because of a replaceable hydrogen atom, but by cutting down the concentration and consequently the adsorption of hydroxyl ions. If calcium ions, for instance, cut down the adsorption of hydroxyl ions sufficiently, calcium hydroxide would behave like an acid, so far as ore flotation is concerned, though it would be alkaline to litmus paper. Somewhat similar cases are known. Under electrical stress albumin moves to the cathode in acid solutions, and also in calcium chloride solutions. The effect is not a question of acidity. The direction in which the albumin moves depends upon the charge of the ion adsorbed in excess. The hydrogen cation and the calcium cation are each adsorbed more than the chlorine anion, and consequently the albumin moves to the cathode in these two solutions. I do not know whether anything of this sort is a factor in modern flotation practice.

Since no systematic experiments have been made to determine the exact effect of temperature, we do not know to what extent the apparent advantages of a heated solution are due to a relative change in the selective adsorption, to a change in the relative densities of the two liquids, or to a change in the viscosities It seems probable that all three changes are factors, but that the change in the selective adsorption is the important one Of course the absolute adsorption must decrease with rising temperature, but the selective adsorption may and probably does, increase with rising temperature At still higher temperatures the decrease in absolute adsorption becomes too serious and there is therefore a maximum temperature which is not necessarily the same under varying conditions.

We now have to consider the part played by air in flotation. Since the density of air is low, it is clear that a film of adsorbed air or an attached bubble of air will be very effective in floating a solid particle If we like we may consider air as an extreme case of a second liquid phase, in which case we may have the solid remaining in the air phase under suitable conditions, concentrating in the interface, or remaining in the water phase. If a piece of metal covered with an air film is laid very carefully on the surface of water, the water may wet it so slowly that the metal will float if it is not too heavy. If the surface of a copper wire be converted to sulphide, it will float more readily because the adsorption of air is more marked. If we have a starch surface, as in the case of copper powder or aluminium powder, the water has still less tendency to wet the solid, and it becomes quite difficult to cause the commercial copper powder or aluminium powder to sink in water. This difference in readiness to wet is made use of in the film flotation processes of Wood and McQuisten.

The concentration of the solid at the interface occurs when a skin forms over the surface of boiled milk or of cocoa or of a peptone solution. I do not know of any case of ore flotation analogous to this, but doubtless one could be devised if anybody was interested in it. In the case of soap solutions we have a partial concentration in the surface, but the bulk of the soap remains distributed through the water phase. The soap, however, adsorbs so much air that boiling-point determinations on concentrated solutions are worthless."

The selective adsorption of gases and vapors by solids is a matter of common knowledge." The film of condensed gas shows itself in the abnormal mobility of very fine powders, in the fact that two pieces of a broken object will not reunite when pressed together, in a resistance to the passage of an electric spark between solid terminals, and in the behavior of the crystal detector and the coherer as used in wireless telegraphy. All liquids show selective adsorption of gases and vapors. The most striking way in which this shows itself is in the form of the splashes when a drop of water, 5 mm. in diameter, falls on a sheet of water from a height of less than 1 meter. It is this film of adsorbed gas which tends to prevent the coalescence of two soap-bubbles or two impinging jets of water when there is no electrical stress.

Since water removes air more or less quickly from practically all minerals, selective flotation from already wetted ore is practically impossible, and one must have recourse to the combined effect of oil and air. It so happens that in acid or neutral solutions air seems to be adsorbed by organic liquids much more readily than by water" Into 100 c.c. approximately normal caustic potash solution 0.5 c.c. chloroform was dropped from a 5 c.c. pipette. The chloroform did not seem to spread out on the surface before sinking so much as it did with water The globules sank to the bottom and flattened out; they were distinctly not very mobile, and seemed to sink to the bottom of the vessel. When the chloroform was dropped into the water it broke up into a number of drops which did not agglomerate so easily as in the water solution. In fact, quite a little shaking was necessary in order to make them coalesce. At first no air bubbles could be detected, but after standing for five minutes a very small bubble appeared on the chloroform Sulphuric acid was then added until the solution became acid. The flattened drop of chloroform at once assumed the shape of a round ball and became mobile An air bubble also appeared in the center of the drop

"Into 100 c.c. approximately normal sulphuric acid solution 0.5 c.c. chloroform was dropped as before The chloroform spread all over the surface and then sank

[9] My attention was first called to this by Mr T R Briggs
[10] Twomey, Jour Phys Chem, 19, 360 (1915)
[11] Jour Phys Chem 19, 370 (1915)

[8] McBain and Taylor, Zeit. phys Chem 76, 189 (1911)
[9] Bancroft, Jour Phys Chem 20, 1 (1916)
[10] Twomey, Jour Phys Chem 19, 360 (1915)

through the solution in small drops, forming round globules with air bubbles clinging to each. It was hard to get rid of the bubbles on the chloroform drops by shaking; as soon as one was driven off another bubble appeared exactly in the center of the drop. When the bubbles were dislodged from the drops, they rose to the surface carrying with them some chloroform, a part of which remained on the surface until it evaporated, while the rest sank back to the bottom of the solution. The globules were very mobile and coalesced readily. Caustic potash was added to the solution, making it alkaline. The chloroform globule flattened immediately and the air bubble in the center disappeared. In still another experiment an acid solution was made alkaline, then acid, and then alkaline again. The result confirmed Wilson's experiments," for the drop of chloroform was always flat in the alkaline solution and always round in the acid solution. There is scarcely any difference to be noted between the shape of the drop in acid solution and in pure water. The same results were obtained when NaOH and HCl were substituted for KOH and H_2SO_4.

"In one experiment in a nitric acid solution the temperature was raised to about 40 deg. C. Bubbles seemed to shoot from all parts of the solution to the chloroform drop. When they had formed a large bubble in the center of the chloroform, the air bubble rose to the surface of the solution as in the other cases."

Of course, it does not follow that the relative adsorption of gas is always greater for oil in acid solution, but merely that this seems to be true in the cases hitherto studied. It is purely an empirical observation. Another interesting fact is the difficulty that is experienced in getting air bubbles to attach themselves in some cases to the oil films surrounding the solid particles. Some people have even claimed that nascent gas is essential, but this is absurd. If the air bubble comes in contact with the oil it will adhere; but it is not easy to bring about this contact. It can be done by vigorous agitation or by causing dissolved gas to come out of solution, but the essential thing is merely to bring the gas in actual contact with the oil.

A large air bubble will have a relatively great lifting power, but it will also tear loose very readily from an oiled particle. We shall get better results if we produce a froth consisting of bubbles of air in oil. Under ideal conditions the film around the bubbles will consist of particles coated with oil. We cannot get a froth with a pure liquid and air. There must be present a third substance in colloidal solution which will tend to form an emulsion of air in the liquid in question, for a froth is essentially a very concentrated emulsion of air in liquid. If the colloidal material is not present in the liquid it must be added. It has often been overlooked that what is needed for ore flotation is a froth of air in oil. People have said to themselves that froth is what is needed and have added saponine and other things with disastrous results. Saponine produces a froth, but it is a froth of air in water and therefore plays havoc with flotation. The things which have proved successful are substances like sodium resinate so called, which produces a froth of air in water in an alkaline solution but one of air in oil in an acid solution, because free rosin forms a colloidal solution in oil but not in water. Mr. Van Arsdale has worded the matter in what seems a different way by saying that the substance added must tend to emulsify water in oil and not oil in water. This is very nearly the same thing, because substances which form colloidal solutions in oil and not in water tend to emulsify water in oil." I have preferred to consider the oil-air interface and Mr. Van Arsdale the oil-water interface, but the two points of view lead to the same conclusions in almost all cases.

So far, we have been considering the case where we have a fair amount of oil. If we cut the amount of oil down almost to a vanishing quantity another factor comes in, namely, air flotation. When sufficient quantities of oil are used, the air floats the oil and the oil floats the ore. The ore is inclosed in a drop of oil having the properties of matter in mass and sinks to the bottom of the drop of oil, distorting it to a greater or lesser extent. If the amount of oil is decreased sufficiently, we no longer have an oil drop surrounding the particle of ore, but an oiled particle, the lower part of which is, or may be, in contact with water, while the upper part is in contact with air. We are therefore getting air effect in addition to the oil effect. I do not know the relative importance of these two effects, but it has been claimed—and disputed—that the modified air flotation is of much greater value than the other. In the Wood and the McQuisten processes there is no doubt but that the separation would be more effective if it were possible to cover the ore particles with a thin film of stearin, leaving the gangue particles uncoated. It is very difficult to wet the stearin-coated commercial copper and aluminium powders, and it is therefore very difficult to make them sink under water. In the modern processes of ore flotation using very little oil per ton, we get a thin coating on the ore analogous to the stearin coating on the copper or the aluminium powder. It is possible that the air film may surround the oiled particle completely so that the oil does not come in actual contact with the water. In that case we are back to a straight air flotation of oiled particles. This point calls for further study because, if established, it would have a very important bearing on the future development of the subject.

It is under these circumstances that addition of more oil causes the ore to cement together and sink. The reason for this will perhaps be seen more easily if we consider the analogy of sand and water. When enough water is mixed with sand, we get a quicksand over which it is unsafe to walk. With only a little water we get a plastic mass over which it is a pleasure to walk and out of which children can make forts, pies, etc. When the sand dries out more, air gets in between the grains, and the walking becomes hard, though the sand is by no means dry from a chemical point of view. When the amount of oil round the ore particles is sufficiently small, the air gets in and makes a froth possible. With more oil we get a plastic mass; with still more we get the bulk oil process.

Anderson[3] classifies flotation oils as "frothing" and "collecting" oils." "There is at times some difficulty in grasping the distinction between frothers and collectors as such, for one oil in itself may, and often does, possess both frothing and collecting properties. The action of a frothing oil is such as to produce froth in greater or less amount, dependent on the frothing power of the oil. A collecting oil has a collecting power for sulphides in preponderance over its frothing action, being therefore, so to speak, a poor frother; a collecting oil may have simply a collecting action and little or no frothing action. As stated in the foregoing, some oils combine both the properties of frothing and collecting in variable degrees of each.

"The most successful frothing oils include the pine oils, cresylic acid and turpentines and other pyroligneous products from the distillation of wood—notably methyl alcohol." The coal tar phenols and their near

[1] Wilson, Jour. Chem. Soc. 1, 174 (1848).
[2] Harkins, Jour. Phys. Chem. 17, 615 (1913).
[3] Met. & Chem. Eng. 14, 188 (1916).
[4] Van Arsdale calls them "frothers" and "others."
[5] This must be an error. W. D. B.

derivatives, and almost all of the so-called essential oils are good frothers. The essential oil of eucalyptus finds favor, particularly in Australian practice, on account of relatively low cost and immediate supply. Castor oil, to which reference has already been made, when mixed 1:4 with kerosene has found application. The more volatile products of petroleum, including kerosene and gasoline [?] have been successful frothing oils."

"So-called mineral oils and tar oils do not generally form a good flotation froth, but have a marked selective action on the sulphide minerals. Among the mineral oils are included the following: asphaltum base, crude petroleum, refined oil, gasoline, burning oil, creosol, and coal-tar creosotes."

"It is found that thick oils tend to form viscous, coherent flotation concentrates, while thin oils form less coherent masses. The action of coal tar in stiffening a weak, ephemeral froth is indicative of the former. In general the essential oils give a coherent froth and satisfactory extraction; oils like oleic acid or candle-maker's red oil, petroleum, and lubricating and engine oils have a strong tendency to produce heavy, thick granules which will not float. Oleic acid has a well-marked power to float silicates."

If a pure liquid does not form a froth with air, it follows that no oils can be frothing oils except in so far as they contain suitable colloidal material suspended in them. In some cases this colloidal material is rosin; in other cases it is for the organic chemist to decide just what the special substance is. Since the good effect of the frothing oils is due to the colloidal substances, it is a question of cost whether it is more advantageous to mix a frothing oil with a collecting oil or to add the constituent which makes the former a frothing oil.

Since we are dealing with selective adsorption, we should expect to find that some oils would be better than others for certain purposes.

Anderson[1] states that "oils derived from the destructive distillation of wood, such as wood creosotes, pyroligneous acid, and the like, are found to give the best recovery on galena and zinciferous material; coal-tar products are being adapted to the successful flotation of copper-bearing minerals." There are no independent data from which this result could have been predicted.

Since flotation is due to selective adsorption, anything which will change the latter will change the degree and nature of flotation as far as the oil-water flotation is concerned. Adding a third liquid which is miscible with the other two will tend to make the oil and water layers more nearly alike in composition and therefore in properties. This gives us a possibility of varying the selective adsorption within certain limits and its possibilities should be determined, even though there may be no economic advantage. Now that we are a little more clear as to the cause of frothing, it becomes possible to study new frothing agents more successfully and it is possible that some of these might have distinct collecting powers of their own. In some experiments recently made at Cornell by Mr. Briggs, it has been found that addition of salt made it easier to shake out colloidal ferric oxide with benzene. The reason for this seems to be that the salt makes the colloidal solution less stable. Any substance which prevents peptization in the water phase or promotes it in the oil phase will tend to increase the flotation. I do not yet know to what extent this is applicable to ore flotation; but Anderson[2] reports that experiments performed on a 60-mesh product from the Joplin district containing pyrite and galena in a calcareous gangue showed: that potassium bichromate will deaden galena and permit the flotation of the pyrite; that sodium, potassium, and ferric sulphates promoted the production of clean concentrates; and that ferrous sulphate and cupric sulphate were very harmful to the successful flotation of this particular product, flotation being practically impossible in their presence. Anderson, of course, ventures no opinion as to why these salts act in this way; but it ought not to be difficult to work out a hypothesis if some data were forthcoming. The inadequacy of the present data is made clear by the statement of R. H. Richards that in the case of a certain Tennessee zinc ore the addition of a small amount of copper sulphate was necessary in order to bring about successful flotation. We have not yet made any experiments on the factors affecting the air flotation when the oil is reduced to a minimum, so I will not discuss that point at all.

There seems to be no reason to suppose that ore flotation has yet gone beyond the first stages of its development, and certainly a clear knowledge of the general theory should be a help in promoting the development.

Cornell University.

[1] Met. and Chem. Eng. 14, 180 (1916).
[2] Met. and Chem. Eng. 14, 187 (1916).

Newark Industrial Exposition

The Industrial Exposition being held at Newark, May 18 to June 3, in the First Regiment Armory, Jay Street (reached by Central Avenue trolley), is representative of the large manufacturing interests of that city. The exhibits are nicely arranged and include a large variety of industries. Among the industrial concerns having space are the following:

Gamon Water Meter Co., water meters.

Standard Oil Co. of New Jersey, Polarine oils and lubricants.

Newark Wire Cloth Co., wire cloth for industrial purposes and screens up to 300 mesh.

Crocker-Wheeler Co., generators, motors.

Westinghouse Electric Co., generators, motors, meters, Westinghouse Mazda lamps.

Murphy Varnish Co., varnish pigments, oils, small grinding rolls, filter presses, etc.

Celluloid Co., celluloid articles.

Driver-Harris Wire Co., Nichrome heat-resisting metal, Monel metal wire, small-wire drawing machine, demonstrating the drawing of copper wire from 0.016 in. to 0.0063 in.

Newark Leather Machinary Company, and combined exhibits of Newark's leather-companies showing different leathers manufactured.

National Oil & Supply Co., Viscoe oils and greases.

Combination Rubber Mfg. Co., hose, packing, etc.

Thomas A. Edison, chemicals, phenol, aniline, etc.

Edison Storage Battery Co., Alkaline storage battery.

General Electric Co., Edison Lamp Works, Mazda lamps, historical exhibit showing development of incandescent lamp.

Anti-Hydro Waterproofing Co., waterproof liquid, waterproof paint, for brick, concrete, etc.

P. W. Horstmann Co., McDowell feed-water heater and purifier.

Bureau of Standards Analyzed Samples.—The Bureau of Standards, Washington, D. C., now has ready for distribution a new sample of its iron D, No. 6-b, replacing No. 6-a, which has been long out of stock. The composition of the new sample is: carbon, 2.39; graphite, 1.79; silicon, 2.59; titanium, 0.077; phosphorus, 0.581; sulphur (gray.), 0.046; manganese, 1.54; copper, 0.044; chromium, 0.014; vanadium, 0.025; nickel, 0.026. Until printed certificates can be had a provisional certificate of analysis, without details, will be furnished with each sample issued.

(Here follow Defendant's Exhibits Nos. 191 to 212, inc., marked pp. 5234 to 5260, inc.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 191.

CHINO COPPER COMPANY
HURLEY PLANT

Data Compiled from Statement (Form 12-C) Showing Results of Operation of Vanner Concentrate Flotation Plant Month of November, 1916.

FLOTATION PLANT FEED

DATE—Nov. 1916	Lbs. Oil Per Ton	% Solids	Dry Tons Per 24 Hrs.	Assay % Copper	Computed % Cu_2S	Assay % Iron	% Iron as FeS_2	Assumed FeS_2 in Conc. and Fe Oxide in Tails — Computed % FeS_2	Compute % Total Sulphide
1	8.06	46.43	420	3.60	4.51	17.8	6.7	14.4	18.9
2	7.96	41.58	360	4.03	5.05	13.1	4.7	10.1	15.2
3	12.09	39.31	330	5.87	7.37	13.5	6.3	13.5	20.9
4	10.09	40.46	284	6.83	8.56	11.1	6.7	14.4	23.0
5	6.97	40.42	318	5.00	6.26	11.5	6.1	13.1	19.4
6	9.23	37.40	310	4.60	5.76	15.3	6.7	14.4	20.2
7	10.04	36.71	282	5.43	6.81	12.8	6.9	14.8	21.6
8	11.53	34.58	235	7.53	9.44	9.2	5.9	12.7	22.1
9	10.06	37.31	248	6.03	7.56	12.3	5.2	11.2	18.8
10	8.97	36.12	291	7 40	9.27	12.1	5.8	12.5	21.8
11	6.15	37.86	334	8.30	10.40	12.0	5.4	11.6	22.0
12	10.67	39.41	312	8.77	11.00	9.1	4.8	10.3	21.3
13	9.05	40.23	375	8.37	10.45	7.1	3.3	7.1	17.6
14	10.80	41.36	345	8.40	10.55	10.2	4.3	9.2	19.8
15	12.22	38.25	270	8.23	10.35	10.0	6.4	13.8	24.1
16	14.23	41.56	292	9.93	12.45	16.0	6.9	14.8	27.2
17	15.46	41.83	280	10.23	12.85	12.7	5.5	11.8	24.6
18	23.98	30.53	176	9.20	11.40	10.7	4.8	10.3	21.7
19	20.61	32.10	206	12.03	15.10	10.5	5.1	11.0	26.1
20	26.98	26.92	179	9.20	11.40	9.6	6.6	14.2	25.6
21	17.68	36.64	244	9.63	12.05	10.8	7.0	15.0	27.0
22	11.31	43.81	358	8.13	10.20	20.0	7.8	16.8	27.0
23	11.81	40.64	326	5.50	6.91	19.2	8.2	17.6	24.2
24	15.09	34.40	285	6.67	8.38	15.1	9.1	19.5	27.9
25	26.14	28.32	184	7.83	9.85	9.2	8.0	18.2	28.0
26	17.37	32.07	247	7.43	9.32	14.1	9.2	19.5	28.8
27	17.85	33.59	221	8.40	10.55	19.5	16.0	34.3	44.9
28	18.41	29.48	208	10.23	12.85	14.4	10.2	21.8	34.6
29	15.51	36.52	254	10.30	12.90	9.8	6.8	14.6	27.5
30	15.04	35.25	270	10.23	12.85	11.1	7.4	15.9	28.7

Compiled from Original Record April 26, 1917.

(Signed) F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 192.

RAY CONSOLIDATED COPPER COMPANY

HAYDEN PLANT

Data Compiled from Monthly Statements (Form No. 62-R) Showing Results of Operation of Vanner Concentrate Retreatment Plant During Year 1916—Divided Into 10-Day Periods.

Period	Lbs. Oil Per Ton	% Water In Feed	ASSAY PLANT FEED		
			% Copper	% Iron	% Total Cu. & Fe.
1	4.21	79.00	5.97	7.04	13.01
2	3.22	77.00	5.64	7.14	12.78
3	2.93	78.00	6.39	7.15	13.54
4	.....	.....	.....	.....	.....
5	3.20	74.00	5.01	6.70	11.71
6	.....	.....	.....	.....	.....
7	2.96	73.00	4.54	6.18	10.72
8	3.28	73.00	4.57	6.40	10.97
9	3.53	76.00	4.68	6.32	11.20
10	3.26	77.00	5.20	6.78	11.98
11	3.41	76.00	5.40	6.86	12.26
12	3.36	75.00	5.12	7.16	12.28
13	3.41	79.00	6.06	7.68	13.74
14	3.01	73.00	5.42	6.77	12.19
15	3.15	75.00	5.26	6.71	11.97
16	3.21	76.00	5.15	6.70	11.85
17	3.13	75.00	5.60	7.19	12.79
18	3.16	78.00	5.96	6.95	12.91
19	3.13	77.00	5.37	6.39	11.76
20	.....	.....	.....	.....	.....
21	3.43	77.00	5.55	6.86	12.41
22	2.72	79.00	6.52	8.22	14.74
23	3.18	80.00	5.76	6.92	12.68
24	3.45	79.00	5.98	7.34	13.32
25	2.83	81.00	5.88	6.84	12.72
26	3.02	79.00	5.73	6.29	12.02
27	3.89	79.00	6.35	6.75	13.10
28	4.24	78.00	6.02	6.56	12.58
29	3.85	79.00	5.97	6.47	12.44
30	4.00	80.00	6.31	7.05	13.36
31	2.81	79.00	5.89	6.74	12.63
32	2.32	78.00	6.05	6.10	12.15
33	2.66	79.00	6.70	6.55	13.25
34	3.65	78.00	6.05	6.36	12.41
35	3.63	79.00	6.24	6.27	12.51
36	.....	.....	.....	.....	.....

Compiled From Original Periodical Record

E. W. ENGELMAN,
Flotation Engineer.

April 30, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 193.

KAY CONSOLIDATED COPPER CO.

HAYDEN PLANT

Data compiled from monthly statements—(Form No. 62-R) showing results of flotation operations for 10-day periods during year 1916. Slime cleaner tailing plant.

Period	Pounds of Oil Per Ton	% of Water in Feed	ASSAY PLANT FEED		
			% Copper	% Iron	% Total Cu & Fe
1	1.53	81.0	.867	1.62	2.49
2	1.53	81.0	.812	1.63	2.44
3	1.82	83.0	.903	1.76	2.66
4	.....	.....	.....	.....	.....
5	1.25	80.0	.814	1.64	2.45
6	1.26	80.0	.818	1.60	2.42
7	1.28	80.0	.785	1.54	2.33
8	1.48	78.0	.810	1.67	2.48
9	1.25	79.0	.896	1.61	2.51
10	.73	78.0	.840	1.59	2.43
11	.77	75.0	.816	1.73	2.55
12	.79	78.0	.726	1.70	2.43
13	.79	77.0	.710	1.67	2.38
14	.99	76.0	.708	1.61	2.32
15	.77	76.0	.680	1.65	2.33
16	.96	77.0	.700	1.72	2.42
17	.95	76.0	.784	1.60	2.38
18	.88	76.0	.770	1.62	2.39
19	.77	75.0	.754	1.68	2.43
20	.....	.....	.....	.....	.....
21	.69	73.0	.719	1.55	2.27
22	.69	79.0	.780	1.72	2.50
23	.74	78.0	.738	1.52	2.26
24	.79	77.0	.713	1.67	2.38
25	.84	78.0	.749	1.73	2.48
26	.88	79.0	.782	1.71	2.49
27	.80	79.0	.805	1.64	2.45
28	.85	77.0	.839	1.67	2.51
29	.82	78.0	.812	1.71	2.52
30	.76	78.0	.700	1.63	2.33
31	.66	77.0	.665	1.64	2.31
32	.73	77.0	.762	1.57	2.43
33	.72	77.0	.753	1.55	2.30
34	.66	78.0	.756	1.58	2.37
35	.63	78.0	.745	1.62	2.36
36	.71	80.0	.783	1.57	2.35

Compiled From Original
Periodical Record.
April 30, 1917.

E. W. ENGELMANN,
Flotation Engineer.

Filed May 18 1917. GEO. W. SPROULS, Clerk.
By H. H. WALKER Deputy

Defendant's Exhibit No. 194.

BUTTE & SUPERIOR MINING COMPANY.

Data Compiled From Original Records of Flotation Plant Operations, Month of November, 1916. Flotation Plant Feed.

Date Nov. 1916	Lbs. Oil Per Ton	% Solids	Assay % Zinc	Computed % ZnS
1	1.67	22.2	15.0	22.4
2	1.50	20.5	13.9	20.7
3	1.48	21.7	13.3	19.8
4	1.50	21.2	14.6	21.8
5	1.55	20.0	13.6	20.3
6	1.53	21.7	15.3	22.8
7	1.74	17.7	13.8	20.5
8	1.75	18.5	14.2	21.1
9	1.58	21.7	15.2	22.6
10	1.52	21.0	15.1	22.5
11	1.50	22.7	12.7	19.0
12	1.91	17.7	13.0	19.4
13	1.68	19.5	12.4	18.5
14	1.28	21.5	12.8	19.1
15	1.56	19.5	11.7	17.5
16	1.44	21.7	15.4	22.9
17	1.16	25.0	13.9	20.7
18	1.28	24.5	12.3	18.4
19	2.37	16.7	12.0	18.0
20	1.23	22.5	12.1	18.0
21	1.40	21.7	11.6	17.3
22	1.58	22.2	11.2	16.7
23	1.44	22.2	11.2	16.7
24	1.43	23.2	12.4	18.5
25	1.40	22.7	12.5	18.7
26	1.69	18.5	11.5	17.2
27	1.31	25.0	11.1	16.5
28	1.36	22.2	12.0	17.9
29	1.54	21.5	12.5	18.6
30	1.36	22.7	12.9	19.2

Compiled From Original Record
April 28th, 1917.

J. T. SHIMMIN.
Mill Superintendent.

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 195.

UTAH COPPER COMPANY

MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Statement Giving Average Results by Months of Operation of Vanner Concentrate Flotation Plant.

September, 1914, to December 1st to 24th, Incl., 1916.

DATA PLATTED ON CHART NO. 1.

	Dry Tons Treated	% Solids in Feed	Lbs. New Oil Per Ton of Original Feed
1914			
Sept.	9,258	41.67	3.05
Oct.	10,085	45.46	2.62
Nov.	13,104	50.00	2.11
Dec.	11,776	40.76	2.23
1915			
Jan.	10,171	42.78	3.97
Feb.	12,686	44.20	1.83
March	16,430	42.89	1.23
April	18.350	42.13	1.85
May	20,229	40.42	2.20
June	19,036	32.10	3.84
July	17,613	36.58	4.63
Aug.	17,778	34.72	3.81
Sept.	19,014	39.40	3.86
Oct.	20,792	40.86	3.77
Nov.	21,211	42.08	4.32
Dec.	21,216	40.56	4.71
1916			
Jan.	18,527	37.18	5.11
Feb.	19,000	34.96	4.97
March	20,003	29.20	5.20
April	21,425	28.82	5.37
May	24,142	31.12	4.69
June	28,510	30.66	3.93
July	29,910	29.20	3.90
Aug.	30,333	32.08	3.87
Sept.	30,266	33.34	3.95
Oct.	32,494	33.20	3.75
Nov.	30,375	33.82	3.76
Dec. (1-24)	24,429	33.45	3.83

Compiled From Original Record Apr. 30, 1917.

(Signed) R. A. CONRADS,
Metallurgical Engineer.

Filed May 18 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 196.

UTAH COPPER COMPANY
MAGNA PLANT
METALLURGICAL DEPARTMENT

Data Compiled From Original Records of Operation of Vanner Concentrate Flotation Plant, for the Year 1916; This Compilation Embraces the Days of the Year on Which the Percentage of Solids in Flotation Feed Was Not Under 31% Nor Over 33%.

DATA PLATTED ON CHART NO. 2.

Date 1916	Per Cent Insol	Per Cent Solids	Lbs. Oil Per Ton
Jan. 12	73.74	32.47	6.12
Jan. 13	73.02	32.65	6.06
Jan. 28	77.76	32.57	6.34
Feb. 13	75.87	31.58	5.00
Feb. 14	75.91	31.01	4.57
Feb. 18	73.08	32.83	4.89
Feb. 19	73.95	31.70	5.35
Feb. 20	73.63	32.30	5.34
Feb. 28	74.24	31.52	5.27
Mar. 7	74.47	32.52	5.03
Mar. 9	74.40	31.21	5.39
Mar. 15	71.35	31.57	4.71
Mar. 16	73.79	31.46	5.40
Apr. 19	72.93	31.90	5.68
Apr. 23	73.16	31.76	5.63
Apr. 25	73.26	32.05	5.41
May 7	77.48	32.17	4.66
May 14	73.38	32.46	4.11
May 21	76.71	31.91	4.57
May 22	76.26	32.53	4.45
May 24	77.46	31.38	4.97
May 29	72.92	31.85	4.54
May 31	73.77	32.96	3.79
June 5	75.42	32.29	4.08
June 6	73.60	32.04	3.95
June 7	75.06	31.42	3.57
June 12	75.31	31.73	4.16
June 14	72.60	31.93	3.95
June 20	75.59	31.80	3.83
June 21	76.72	31.68	4.12
June 23	75.89	32.08	3.45
June 29	76.07	31.68	3.82
July 8	74.84	31.42	3.70
July 25	75.57	31.18	3.91
July 26	76.97	31.24	4.20
July 31	75.75	31.35	4.12
Aug. 1	74.53	31.02	4.17
Aug. 2	74.14	31.98	3.60
Aug. 4	74.26	32.05	3.61
Aug. 8	74.47	31.36	3.80
Aug. 9	75.46	31.61	3.76
Aug. 11	75.70	32.49	3.66
Aug. 12	75.51	32.97	4.02
Aug. 13	75.44	32.31	3.82
Aug. 14	75.70	31.14	3.67
Aug. 22	74.11	31.53	3.84
Aug. 24	74.53	32.22	3.84
Aug. 25	75.10	31.57	3.88
Aug. 26	74.71	31.99	4.18
Aug. 28	73.81	32.22	4.13
Aug. 31	74.84	32.68	4.05
Sept. 4	72.95	32.28	4.28
Sept. 11	75.86	32.86	3.88
Sept. 12	75.77	31.15	4.23
Sept. 14	75.10	31.95	4.42
Sept. 18	74.80	31.22	4.30
Sept. 20	73.06	32.03	4.03
Sept. 22	74.08	31.96	3.99
Sept. 23	74.60	31.54	4.24
Sept. 24	74.13	31.70	3.99
Sept. 26	75.00	32.30	4.29
Sept. 27	74.40	32.40	3.84
Oct. 7	74.82	31.12	4.14
Oct. 8	74.47	31.36	3.89
Oct. 14	75.10	32.36	3.75
Oct. 16	73.76	32.89	3.67
Oct. 18	72.94	32.41	3.76
Nov. 8	77.51	31.02	4.23
Nov. 11	75.42	32.57	3.67
Nov. 12	75.58	31.99	3.83
Nov. 17	76.25	32.70	3.59
Nov. 18	77.00	32.63	3.64
Nov. 19	75.08	32.83	3.52
Nov. 20	79.08	31.12	5.22
Dec. 7	77.70	32.58	3.58
Dec. 8	77.68	32.35	3.62
Dec. 12	76.36	32.71	4.07
Dec. 15	77.54	31.40	3.74
Dec. 19	75.84	31.96	3.37
Dec. 23	77.76	32.66	3.83

Compiled From Original Record Apr. 29, 1917.

(Signed) R. C. CONRADS
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy

Defendant's Exhibit No. 197.

UTAH COPPER COMPANY

MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Records of Operation of Vanner Concentrate Flotation Plant for Year 1916.

This Compilation Embraces the Days of the Year on Which the Percentage mineral (100% - % Insol.) in Feed Was Between 24.5% and 25.5%.

DATA PLATTED ON CHART NO. 3.

1916 Date	% Insol.	% Solids	Lbs. Oil Per Ton
1- 1	75.13	37.07	4.61
1-11	75.23	33.71	5.87
1-16	75.15	34.57	5.00
3- 5	75.33	28.58	5.57
3- 8	74.58	26.44	5.68
3-10	75.46	30.58	5.70
3-17	74.62	26.20	6.65
3-27	74.76	26.94	4.55
3-29	74.83	29.34	4.26
4- 6	74.70	30.49	4.16
4-10	74.66	29.89	5.54
4-14	75.06	30.09	5.74
4-28	75.33	28.76	5.19
4-30	74.96	28.29	5.78
5- 3	74.67	28.70	5.87
5- 4	75.49	30.10	5.51
5- 5	74.77	29.77	5.73
5-12	74.60	30.54	4.45
5-17	75.36	34.03	4.47
5-26	75.31	33.08	5.15
6- 1	74.94	33.98	4.08
6- 3	75.36	33.02	4.36
6- 5	75.42	32.29	4.08
6- 7	75.06	31.42	3.57
6- 8	74.50	29.97	3.64
6-12	75.31	31.73	4.16
6-15	75.47	27.91	4.28
6-24	75.10	29.65	3.40
7- 8	74.84	31.42	3.70
7-12	75.47	27.36	3.82
7-13	74.66	27.68	4.51
7-14	74.96	25.96	3.88
7-15	75.33	27.12	4.06
7-20	75.26	28.18	4.34
7-22	75.17	29.26	4.74
7-24	75.17	29.23	4.15
7-29	75.22	30.77	4.29
8- 1	74.53	31.02	4.17
8- 9	75.46	31.61	3.76
8-10	75.33	29.62	3.94
8-13	75.44	32.31	3.82
8-21	75.47	34.05	3.78
8-23	75.30	35.95	3.90
8-24	74.53	32.22	3.84
8-25	75.10	31.57	3.88
8-26	74.71	31.99	4.18
8-27	74.84	33.27	3.97
8-31	74.84	32.68	4.05
9- 1	74.70	35.88	4.29
9- 7	75.70	33.34	4.20
9- 8	74.65	33.90	3.81
9-14	75.10	31.95	4.42
9-18	74.80	31.22	4.30
9-23	74.60	31.54	4.24
9-25	74.83	30.45	4.57
9-26	75.00	32.30	4.29
9-28	75.20	34.43	3.63
10- 3	75.11	33.34	3.78
10- 7	74.82	31.12	4.14
10-12	74.85	30.60	4.03
10-14	75.10	32.36	3.75
10-23	75.00	34.16	3.63
10-30	75.43	34.29	3.80
11- 6	75.13	35.12	3.81
11- 9	74.50	35.30	3.78
11-10	74.76	34.34	3.79
11-11	75.42	32.57	3.67
11-19	75.08	32.83	3.52
11-26	74.80	36.10	3.42
11-30	74.80	37.74	3.39
12- 2	75.32	34.40	3.56
12- 4	74.89	34.75	3.03
12- 6	75.36	33.45	3.67
12-14	75.11	35.54	3.90
12-17	75.33	34.61	3.73
12-18	74.93	36.37	3.72

Compiled From Original Record April 29, 1917.

(Signed) R. A. CONRADS, Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 198.

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Record of Operation of Flotation Plant Treating Original Slime Feed.

The Dates Embraced in This Compilation Are Sept. 1st to Oct. 31st, 1916, Inclusive, Excepting Oct. 8th to 12th Inclusive, on Which Days a Different Oil Mixture Was Used. a

DATA PLATTED ON CHART NO. 1.

Date	HEADING % Cu.	% Fe.	Lbs. Oil Per Ton	% Solids
Sept.				
1	.939	1.47	1.26	17.37
2	.957	1.35	1.21	18.07
3	1.111	1.12	1.34	17.79
4	1.162	1.20	0.98	20.03
5	1.097	1.80	1.35	17.05
6	1.075	1.50	0.82	19.30
7	1.193	1.30	1.21	19.98
8	1.066	1.35	1.22	16.25
9	1.052	1.33	1.41	16.49
10	1.119	1.35	1.25	17.91
11	1.080	1.73	0.95	18.58
12	1.048	1.65	1.16	17.31
13	1.067	1.05	1.17	21.20
14	1.042	1.47	1.46	17.60
15	1.022	1.60	1.32	16.49
16	1.056	1.33	1.21	17.34
17	.873	1.50	1.41	17.74
18	.874	1.33	1.35	17.75
19	.901	1.60	1.45	17.26
20	1.010	1.57	1.05	18.32
21	1.000	1.85	1.29	17.43
22	1.490	1.51	1.60	19.55
23	1.047	1.03	1.44	17.46
24	.944	1.33	1.54	17.37
25	.968	.93	1.78	17.06
26	1.011	1.03	1 68	15 88
27	1.119	1.05	1.22	19.55
28	.992	.93	2.83	12.79
29	.954	1.25	0 99	19.13
30	.950	1.28	1.75	18.26
Oct.				
1	.997	1.15	1.13	18.39
2	1.087	1.18	1.32	15.53
3	1.066	1.52	1.29	16.74
4	1.092	1.42	1.52	18.94
5	1.148	1.35	1.65	18.20
6	1.035	1.46	1.61	16.56
7	1.125	1.15	1.39	15.90
13	.992	1.16	1.52	18.29
14	1.096	1.60	2.22	12.34
15	.968	1.11	2.45	12.19
16	.989	1.25	1.71	12.90
17	1.010	1.46	2.02	16.19
18	1.196	1.28	1.46	17.98
19	1.063	1.21	2.13	13.13
20	1.066	1.63	1.49	14.40
21	1.118	1.06	1.22	16.07
22	1.030	1.30	.97	16.55
23	1.061	1.53	1.10	17.70
24	1.068	1.10	1.44	15.09
25	1.141	1.38	1.41	15.17
26	1.363	1.21	1.65	16.66
27	1.320	1.25	1.81	13.83
28	1.062	1.62	2.26	16.14
29	1.150	1.55	1.86	14.90
30	1.193	1.27	1.55	18.05
31	1.307	1.88	1.42	18.48

Compiled From
Original Record.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

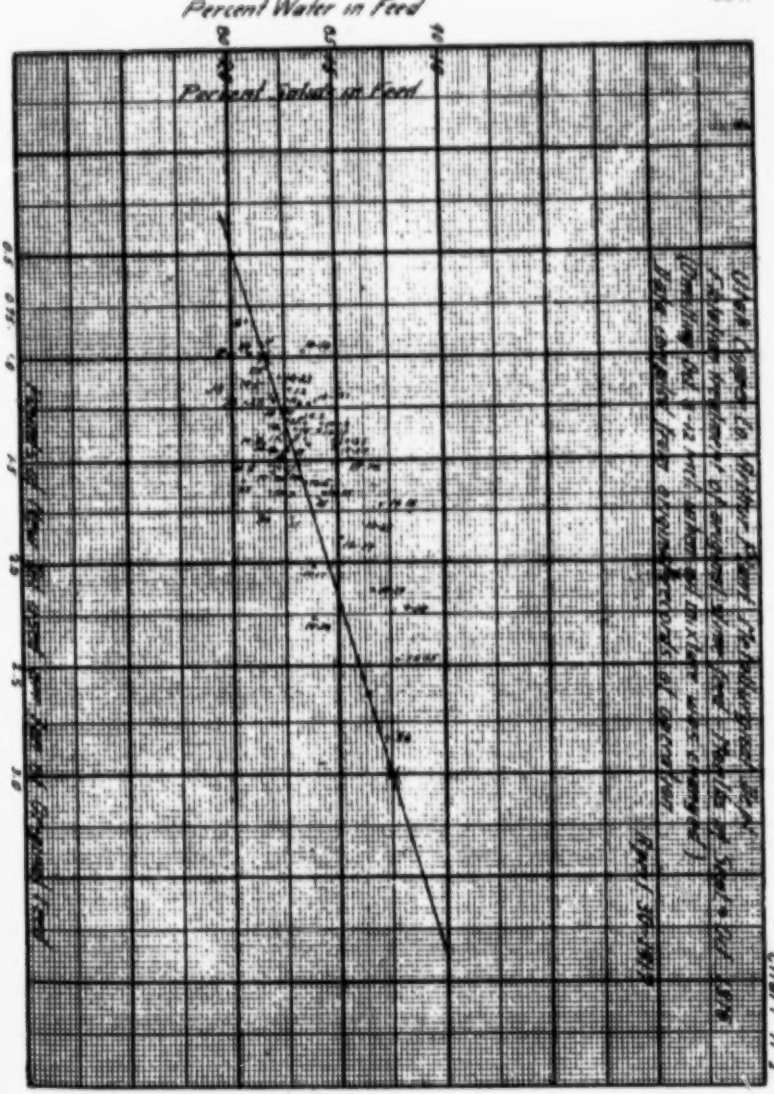
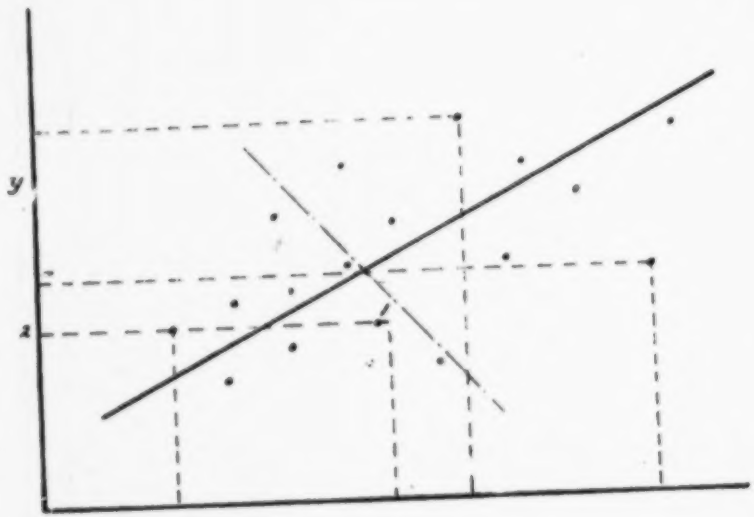


Chart A-1

DIAGRAM NO. 24 — DEF. EXHIBIT NO. 200—A. F. T.



$$y = Ax + B$$

$$2 = 1A + B$$

$$2.2 = 3A + B$$

$$4.2 = 4A + 2B$$

$$4 = 3.5A + B$$

$$2.5 = 5A + B$$

$$6.5 = 8.5A + 2B$$

$$4.2 = 4A + 2B$$

$$2.3 = 4.5A$$

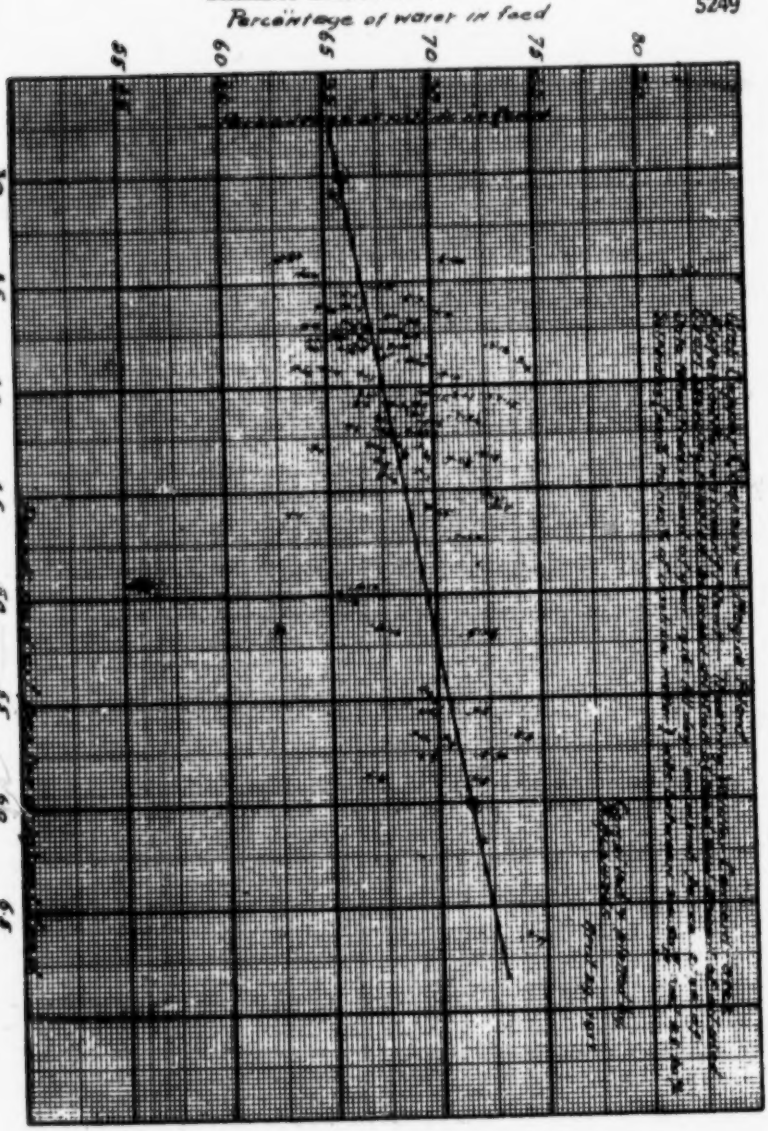
$$A = \frac{2.3}{4.5}$$

$$B = 1+$$

$$y = \frac{2.3}{4.5}x + 1+$$

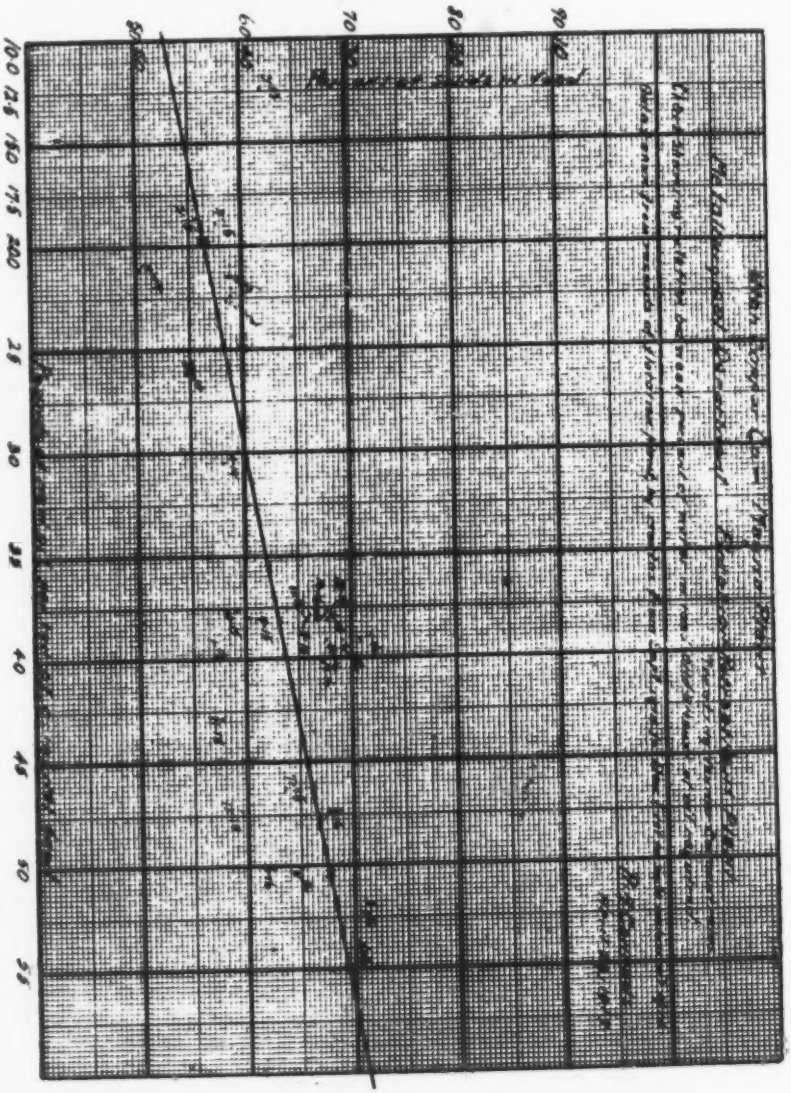
Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H WALKER, Deputy.

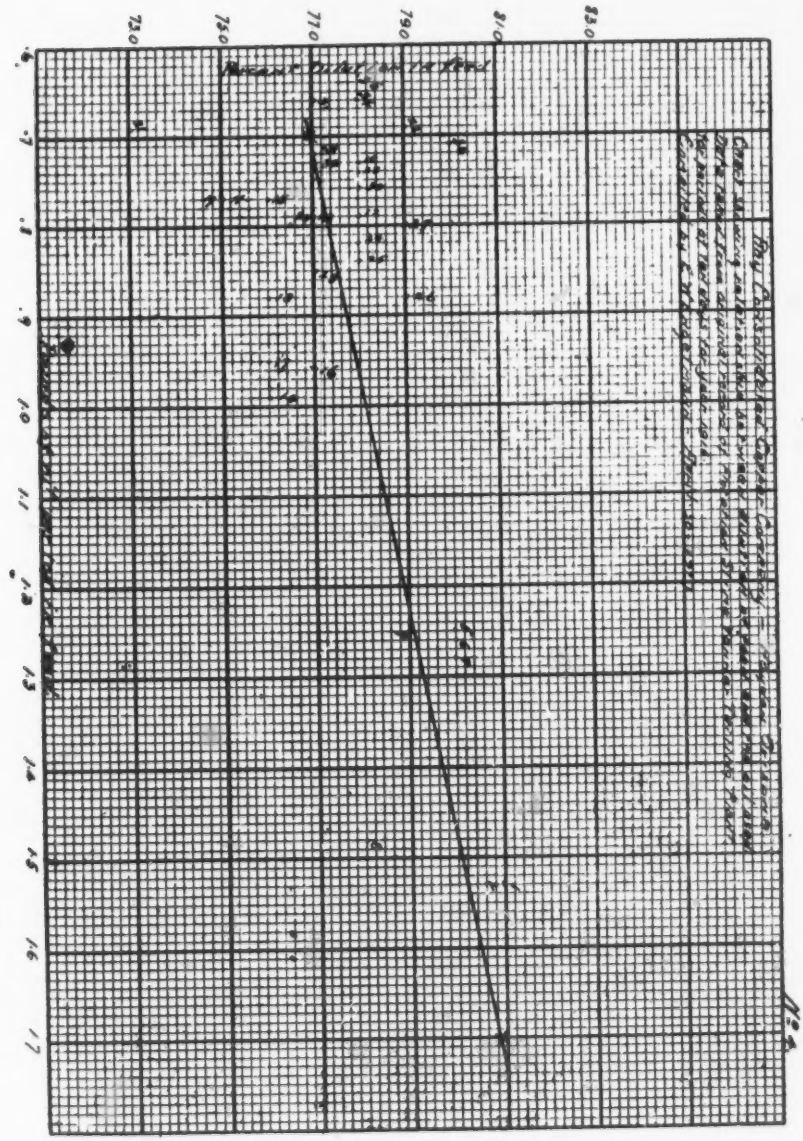
Defendant's Exhibit No. 201.

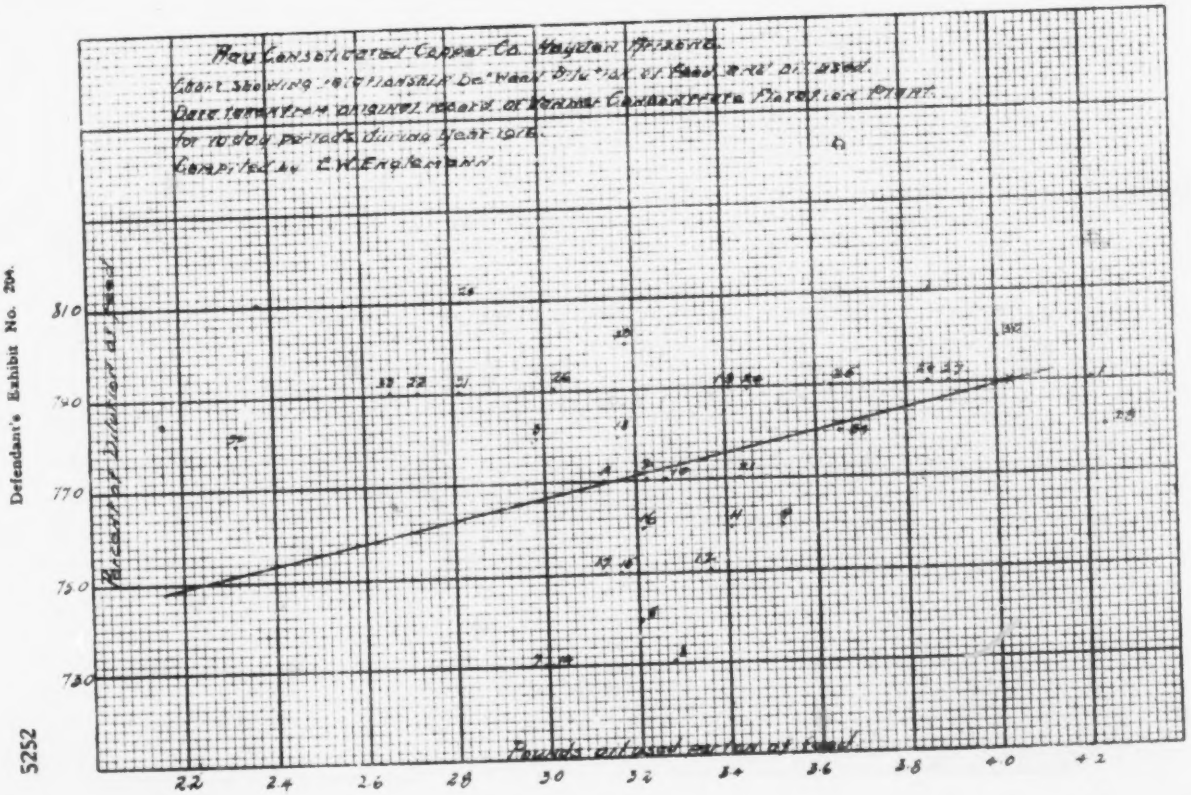


Defendant's Exhibit No. 202.

5250




730
750
770
790
810
830

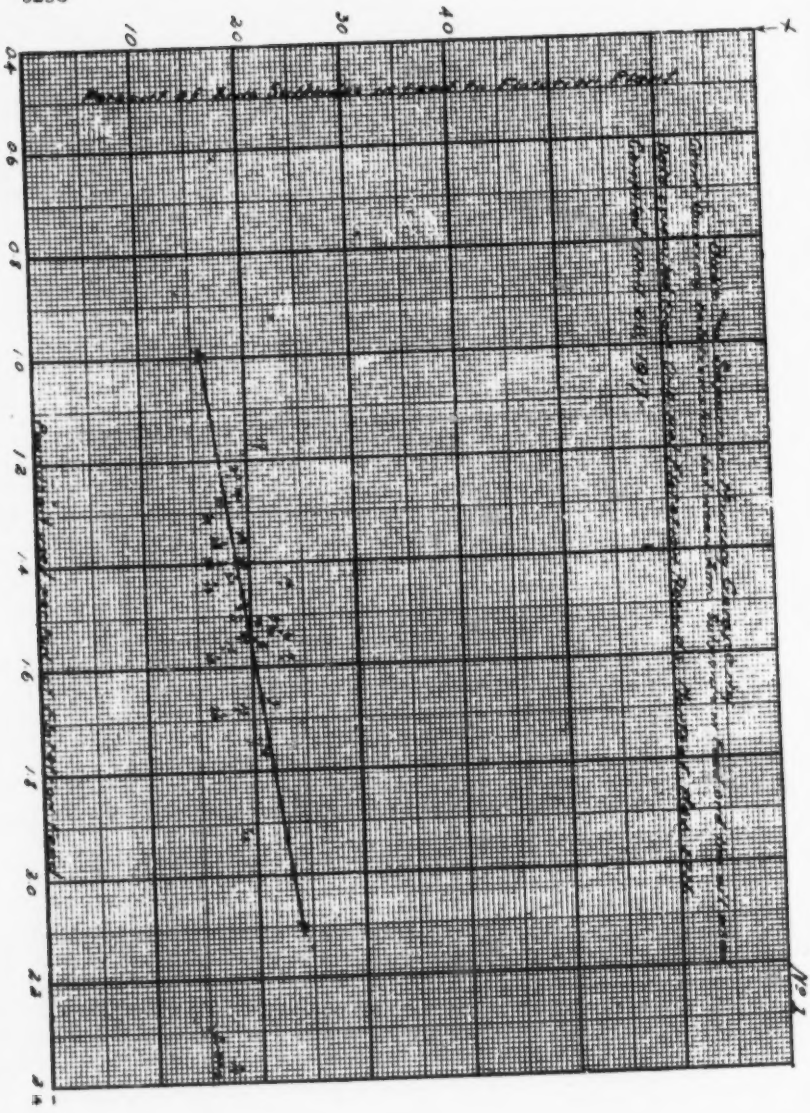

Plan Consolidated Copper Co. Hayden Arizona.
Chart showing relationship between Distance of Face and Distance
Date indicates the original record of Face Elevation plotted.
for 10 foot periods during last 10 ft.
Compiled by C.W. Engelmann
Defendant's Exhibit No. 204.
5252
Elevation of Face
810
790
770
750
730
Pounds advanced per ton of coal
22
24
26
28
30
32
34
36
38
40
42

Defendant's Exhibit No. 206.

Defendant's Exhibit No. 207.

5255

Defendant's Exhibit No. 208.

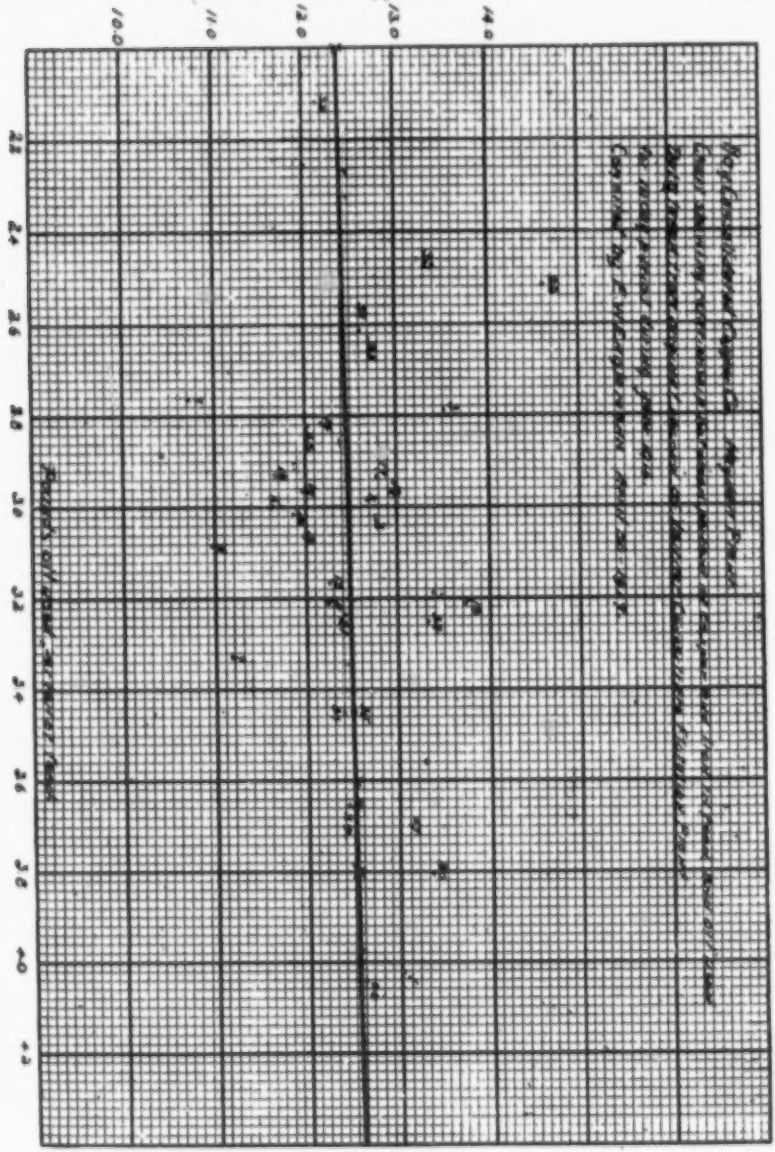


Percent of Total Sulphides in Feed
Pounds of Dry Weight Per Ton of Feed

Defendant's Exhibit No. 210.

Defendant's Exhibit No. 211.

Percent total Copper and Iron.



Defendant's Exhibit No. 212.

UTAH COPPER COMPANY
ARTHUR PLANT

TEST NO. 1—MACHINE NO. 1—RETREATMENT PLANT
13 CELLS, FULL FEED, NO CIRCULATION

TEST PERFORMED 9:30 P. M. TO 10:30 P. M. APRIL 21, 1917.

		% COPPER					
	Tonnage	Total	Carb.	Sulphide	% Fe.	% Ins.	% Sulphide
Heading	10.1	4.700	.115	4.585			42.26
Tailing	7.1	.800	.045	.735	10.50	52.50	10.94
Concentrate	3.0	14.150	.145	14.005			3.42
Ratio of concentration							87.95
Per cent indicated extraction (Total Cu)							88.29
Per cent indicated extraction (sulphide)							220
Pounds oil added							21.78
Pounds oil added per ton							

Oils: 66⅔% Smelter Fuel,
34⅓% Jones

Reagent—Calura.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5261 Defendant's Exhibit No. 213.

Utah Copper Company.

Arthur Plant.

Test No. 2—Machine No. 1—Retreatment Plant, 13 Cells, Full Feed, No Circulation.

Test Performed 7:45 to 8:45 p. m., April 21st, 1917.

	Tonnage. 24 hrs.	% Copper. Total.	Carb.	Sulphide.	% Fe.	% insol.	% solids.
Heading ..	460	4.875	.060	4.815	.....	.....	42.00
Tailing ...	302	.462	.020	.440	.....	.....	20.29
Concentrate	158	13.300	.220	13.080	10.20	39.20	10.60

Ratio of concentration	2.91
Per cent indicated extraction (total cu.)	93.78
Per cent indicated extraction (sulphide)	94.02

Oil Analysis on Products.

	Lbs. per ton.
Tailing	23.16
Concentrate	491.80

Oil and Reagents for Test.

Pounds oil added per ton	249.83

Oils: 59% Smelter Fuel
30% Jones
10% American Creosote No. 2
1% Yuryan Pine

Reagent—Calura.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5262 Defendant's Exhibit No. 214.

Ray Consolidated Copper Company,

Hayden Plant.

Data Compiled from Monthly Statements (Form No. 62-R) Showing Results of Operation of Vanner Concentrate Retreatment Plant During Year 1916.

Divided into 10-day Periods.

These Figures Submitted Below Consist of the Missing Periods as Shown by Similar Report Compiled by Me on April 30, 1917.

Period.	Lbs. oil per ton.	% water in feed.	Assay plant feed. % copper.	% iron.	% total cu. & fe.
4.....	3.60	76.00	4.78	6.14	10.92
6.....	3.12	73.00	5.55	6.50	12.05
20.....	3.04	77.00	5.55	6.86	12.41
Missing Data for Slime Vanner Tailing Plant.					
4.....	1.50	80.00	.80	1.60	2.40
20.....	.66	73.00	.72	1.54	2.26

Respectfully submitted,

(Signed) E. W. ENGELMANN,

Flotation Eng'r Ray Con. Cu. Co., Hayden, Arizona.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follows Defendant's Exhibit No. 215, marked pages 5263 to 5268G, inclusive.)

Butte & Superior Mining Company. 5263

Defendant's Exhibit No. 215.

URE'S DICTIONARY

OF

ARTS, MANUFACTURES, AND MINES

A CLEAR EXPOSITION OF THEIR PRINCIPLES AND PRACTICE

EDITED BY ROBERT HUNT, F.R.S. F.S.S.

Illustrated with nearly Two Thousand Engravings on Wood

FIFTH EDITION, CAREFULLY REVISED AND GREATLY ENLARGED

IN THREE VOLUMES—VOL. III

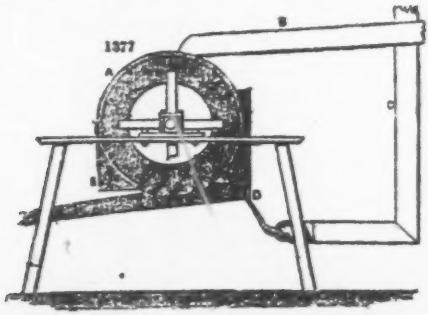
LONDON
LONGMAN, GREEN, LONGMAN, AND ROBERTS
1860

331 **ORES, DRESSING OF.**

sined from a pressure-column ten feet in height, and passes directly into the funnel, of a round buddle.

The wheel A, *fig.* 1377, is four feet in diameter, two feet six inches in breadth; has

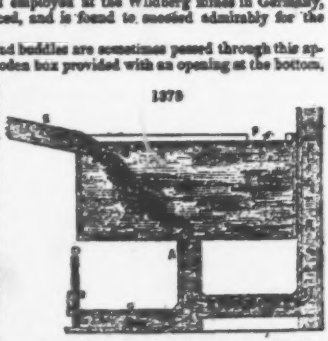
1377



twenty-four buckets, and makes five revolutions per minute; B, launder for supplying the finely-pulverised ore; C, pressure-column; D, jet-piece; E, launder for conveying off the slime overflow of the wheel; F, launder for conveying roughs to round buddle. A modification of this apparatus is employed at the Wildberg mines in Germany, where it has been recently introduced, and is found to succeed admirably for the classification of finely-divided ores.

Sizing cistern.—The tails from round buddles are sometimes passed through this apparatus. It consists, *fig.* 1378, of a wooden box provided with an opening at the bottom, A, which is in communication with a pressure-pipe, B, an outlet, C, and has a small regulating sluice, D. The stuff from the buddles enters at E, and the pressure in the column is so regulated as to allow the heavier particles of the stuff to descend, but at the same time to wash away at F the lighter matters that may be associated with the ore. This is done by having the outlet C of less area than the inlet, and fixing on the extremity D a convenient regulating sluice by which means a greater or less quantity of stuff may be passed over the depression F. Two cisterns of this kind are generally employed, the second being used to collect any rough particles that may have passed off from the first. The depth of the first of these boxes may be eighteen inches, its width thirteen inches, and its length three feet six inches. The dimensions of the second may be considerably less.

1379



The arrangement of another separating box is shown in *figs.* 1379 and 1380. The slime water flows in at H; and water still holding a considerable portion of slime flows away from the opposite end. It is necessary that pieces of chip, small lumps, or other extraneous matter should be intercepted previous to entering this apparatus, also that the slimes should be evenly sized by means of a trommel or sieve. The heaviest portion of the slime water in which the sand and ore is contained, is discharged at a, which is about an inch square. The launders *p p*, are for the purpose of conveying the slime water either to buddles or shaking tables. The dimensions of the cistern No. 1 are, length, six feet; width, one and a half feet; depth, twelve inches. But two other cisterns of similar form are attached. No. 1 cistern will work about ten tons of stuff in twenty-four hours, and by widening the box from eighteen to twenty-seven inches it will get through twenty tons in twenty-four hours. Affixed to one side of the boxes are hammers so contrived as to give thirty blows per minute in the

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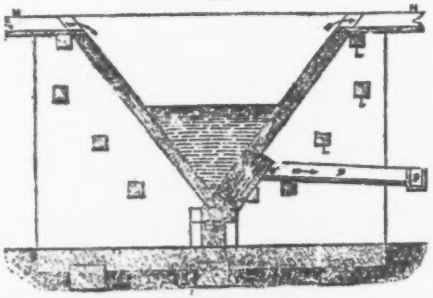
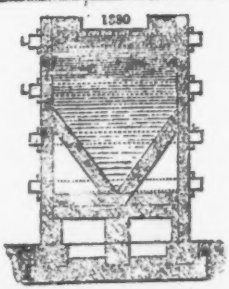
manner of a dolly tub. The sides of the box have an angle of fifty degrees from the horizontal. The chief dimensions of the two cisterns viz. one working ten and the other twenty tons, are subjoined.

No. of Box.	Ten tons.			Twenty tons.		
	Length of Box.	Breadth of Box.	Depth of Box.	Length of Box.	Breadth of Box.	Depth of Box.
	ft.	ft.	ft.	ft.	ft.	ft.
2	9	3	6	9	5	6
3	12	4	8	12	9	8
4	15	8	10	16	15	10

1379



1380



According to experiments made in the Stamping House of Schemnitz, where twelve tons are stamped in twenty-four hours, the first cistern separated from the slimes 40 per cent. of the ore; the 2nd cistern, 22 per cent.; the 3rd cistern, 20 per cent.; the 4th cistern, 12 per cent.; together, 94 per cent., leaving a loss of 6 per cent.

From No. 1 box every cubic foot of water flowing through gave 16 pounds of ready metal. No. 2 afforded 13 pounds of finer stuff. No. 3, 10 pounds, and No. 4 yielded 12 pounds per cubic foot of water. It should be remarked that the outlet is proportioned to the dimensions of the machine.

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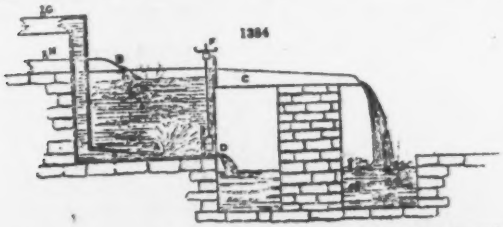
Wilkin's separator.—This apparatus is the invention of Mr. J. B. Wilkin of Wheal Bassett and Grylls, near Helston. He describes it as a "self-acting tossing



1384

machine, by which the rough particles are separated from the fine and prepared for the inclined plane. The ovey matter is carried into a small cistern by a stream of water which enters at the top and passes out at the opposite side bearing the finer particles with it, whilst the rougher and heavier particles escape at the bottom through a rising jet of clean water, which prevents the fine and light particles from passing in the same direction." A, *fig.* 1384, inlet of clean water, B, launder delivering the ovey matter, C, outlet of fine and inferior stuff, D, discharge orifice for rough and heavy stuff. This operation must be regulated by a flood-shut. A cistern 10 feet square on the top, and 18 inches deep will pass through about 40 tons in 10 hours. When separating stamps work a smaller cistern is employed, say 14 inches square, 10 inches deep, this will despatch 6 tons in 10 hours.

A valuable form of separator is shown in *fig.* 1385, the peculiarity of which consists

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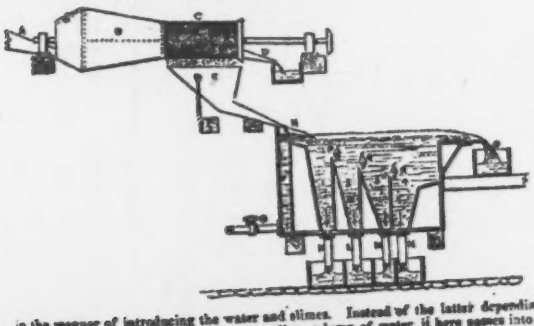
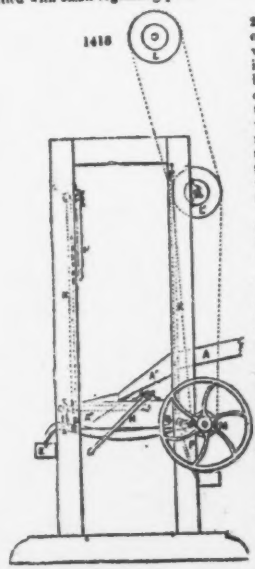


in the manner of introducing the water and slimes. Instead of the latter depending for separation upon the power of an ascending column of water, it here passes into a horizontal flow of greater or less volume and velocity, produced by altering the tap a. Compartments, viz. 1, 2, 3 and 4, are also fitted in the box, for the purpose of receiving mineral of different densities and size, which is discharged and washed in strips set underneath; A, inlet launder to trommel; B, waist of sheet iron; C, trommel either of perforated plate, or wire gauze; D, shoot from trommel serving to convey away the rougher portions; E, hopper for conveying stuff to shoot H, and from thence into the box; F, ascending column of water; G, tap for regulating the flow of water; K, L, M, N, outlet pipes for delivering the separated stuff to strips or buddies; O, launder for receiving overflow from cistern; P, Q, R, valves regulating the width of the compartments, also for the purpose of effecting the disposition of the different minerals with which the ore may be associated.

frame B. The slime box A'' is perforated at D with numerous holes, each of which is fitted with small regulating pins.



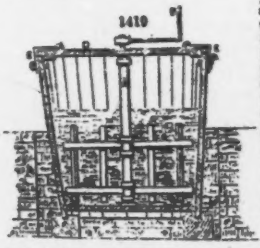
The table D D is 2 feet 2 inches wide, and 2 feet 10 inches long, with a bottom formed of copper gauze. It is suspended by the vertical rods K K, and varying degrees of inclination are given to the table by altering the levers H H. For the purpose of quickening or decreasing the action of the table two cones are employed, L L', upon which the driving band is shifted as may be necessary. A band from a runner, fitted on the axis of the cone L, communicates motion to a pulley wheel, M, upon the shaft of which are cranks attached to connecting rods O, giving motion to the table.

When the machine is in operation, the ore flows over at F, into the launder beneath it, whilst the waste is carried over the opposite end into the trough E.

Professor B. Silliman, Jun., and Mr. J. D. Whitney give the following particulars of results realised by this machine:—The total weight of ore stuff dressed during 122 days was 11,948,900 pounds of rock stamped and crushed, or 5,080 tons miners' weight.

The total ore sold from this quantity of stuff was 128 gross tons (2352 lbs.), or 2 $\frac{32}{100}$ per cent. of the stuff worked over. By the Captain's vans the average richness of the stamp work (forming much the larger part of what goes to the separators) for 22 weeks was 2·33 per cent. The humid assay of the average work from the stamps for five weeks in July and August, gave for the richness of the stuff dressed on the separators 3·20 per cent. of ore, or ·984 per cent. of metallic copper. There is, therefore, an apparent loss in the tailings of $\frac{1}{10}$ per cent. of 80 per cent. ore, or $\frac{1}{30}$ of copper. The amount of ore, however, lost in the tailings does not exceed $\frac{1}{4}$ to $\frac{1}{5}$ per cent., or about $\frac{1}{100}$ per cent. of copper. The actual products of working, therefore, as may be seen, exceed for the machines the average richness of the Captain's vans.

Of the total ore produced in this time, 181,126 pounds came from the separators, and 160,858 pounds from the jiggers. The whole amount of stuff therefore required to produce this amount of ore, estimated from the above ratio (1·15 : 1) is 768,680 pounds. This may be taken approximately as the actual quantity which passed over the separators, and if calculated on the Captain's vans, it should have produced 177,961 pounds of ore, while in fact it did produce 181,126 pounds, or a variation in excess for the machines of only 3,210 pounds. Each of the separators therefore dresses about 1½ tons of rock daily, of stuff yielding an average of 2·3 per cent. of 80 per cent. ore.



Dolly tub or packing sieve.—This apparatus is employed for the purpose of excluding fine refuse from slime ore, which has been rendered nearly pure by previous mechanical treatment. In using it the workmen proceed thus:—The sieve, *fig.* 1419, is filled to a certain height with water, and the dolly A introduced. A couple of men then take hold of the handle B, and turning it rapidly cause the water to assume a circular motion. The tossing is then

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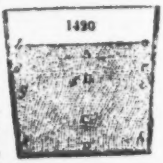
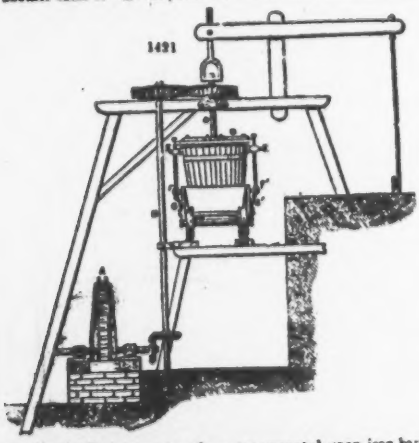
commenced by sloshelling in the slime until the water is rendered somewhat thick. After continuing the stirring for a short period, the hasps E E are loosened, and the bar D with the dolly are suddenly withdrawn. The tub is then packed by striking its outside with heavy wooden mallets. When this operation is terminated, the water is poured off through plug-holes in the side of the tub.



The object of the rotary motion created by the dolly is to scour off clayey or other matter adhering to the ore, whilst the packing hastens the subsidence of the denser portions. In one operation of this kind four distinct strata may be produced, as indicated by the lines *a b*, *c d*, *e f*, *g* A *c* A, in *fig.* 1420.

The upper portion, viz. from A to B, will probably have to be set aside for further washing, whilst the schlich C should be fit for market. The conical nucleus in the centre of the tub generally consists of coarse sand, and is usually further enriched on a copper bottom sieve, or else submitted to the action of a tye, or other suitable apparatus.

Machine dolly tub. — This sieve is packed by machinery represented in the accompanying woodcut, in which A is a small water-wheel working a vertical shaft B, and driving another shaft C. At the bottom of this is fixed a notched wheel D, which



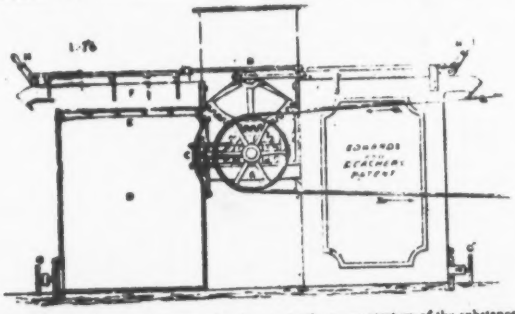
presses outwardly the hammers E E; these are mounted upon iron bars F F', and violently driven upon the side of the sieve by means of springs G G'.

The degree to which ore can be concentrated by dollying must evidently depend upon several conditions: — 1st. The initial percentage of the ore. 2nd. The condition to which it is reduced. 3rd. The matrix with which it is associated. 4th. The proportion of water employed. And lastly, if the rotation and packing have been judiciously performed. An experiment upon some sandschlich lead ore, much intermixed with fine carbonate of iron, gave the following results: —

Introduced into dolly tub, 17 cwt., assayed, 48%.		
Time required to introduce stuff	6	minutes.
Dolly rotated	5	"
Dolly withdrawn —		
Tub packed	5	"
Running off water	6	"
Skimming and cleaning out tub	20	"
Total	42	

Filed May 18 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

B, which is driven at a slower rate by means of toothed wheels, and moves by cranks or eccentrics a horizontal motion backwards and forwards to and from the scrapers F, above



the cisterns. These are so arranged as to remove the upper stratum of the substance being acted upon, and discharge it into waggons or other convenient receptacles; these upper strata are of course the lightest, the heavier part settling upon the perforated plates below.

When from the action of the machine a considerable quantity of material has accumulated upon these plates, the scrapers are thrown out of gear by means of apparatus attached, n n, and the stuff raked off, the operation being then continued on fresh supplies. Doors, o o, at the bottom of the machines admit of any fine stuff which may pass through the perforated plates being removed from time to time as may be necessary.

These machines are in use for cleansing coal as well as other mineral substances. In such cases the heavier stuff which remains upon the plates consists of shale, pyrites, &c., very injurious substances in the manufacture of coke. One machine of two connected cisterns, is capable of washing about thirty tons per diem of coal, but the quantity of mineral work will depend upon the amount of ore present in proportion to the waste. The size of the perforations in the screens is adapted to the quality of the material acted upon.

A gold washing machine has been arranged by Mr. John Hunt, late of Pont-Pean, France. This gentleman states that it requires but little water, and is so contrived, as to circulate this water for repeated use; also that the principle would be found very successful if employed on a more extended scale; this Mr. Hunt intends to carry into operation at some lead mines in Cornwall.

Separators.

Of late years apparatus of this class has been steadily coming into operation, not only in lead and copper mines, but also in the dressing of tin ores. The prevailing principle is that of directing a pressure of water against the density of the descending material, making the former sufficiently powerful to float off certain minerals with which the ore may happen to be associated. When marked difference of densities exist, and the ore can be readily freed from its gangue, this mode of separation will be found effective. Trommels may be advantageously employed for sizing the stuff previous to its entry into the several separators.

Slime separator.—This apparatus is due to Captain Isaac Richards, of Devon Great Consols, and is employed for removing the slime from the finely-divided ores which have passed through a series of sieves set in motion by the crusher. The finely-divided ores are for this purpose conveyed by means of a launder upon a small water-wheel, thereby imparting to it a slow rotary motion. Whilst this is turning time is allowed for the particles to settle in accordance with their several densities; the result obtained is that the heavier and coarser grains are found at the bottom of the buckets, whilst the lighter and finer matters held in suspension are poured out of the buckets and flow away through a launder provided for that purpose. The stuff remaining in the bottom of the buckets is washed out by means of jets of water ob-

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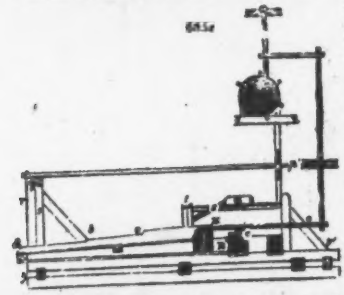

This machine was in constant use at the Great Polgooth Mine for some time, and it is said effected a saving of 30 per cent. in the dressing of slime ore. It is not so well adapted for rough as for the treatment of fine slimes; the apparatus may be managed by a boy at 8*d.* per day, and the cost of the machine complete is about 60*l.*

Percussion table or Stossherd. — The diagrams, *figs.* 685*r*, 685*s*, and 685*t*, exhibit a plan, vertical section, and elevation of one of these tables, used in the Harz. The arbor or great shaft, is shown in section perpendicularly to its axis, at A. The cams or wipers are shown round its circumference, one of them having just acted on *n*.

These cams, by the revolution of the arbor, cause the alternating movements of a horizontal bar of wood, *o*, *u*, which strikes at the point *u* against a table *d*, *b*, *c*, *u*. This table is suspended by two chains *f*, at its superior end, and by two rods at its lower end. After having been pushed by the piece, *o*, *u*, it rebounds to strike against a block or bracket B. A lever *p*, *q*, serves to adjust the inclination of the movable table, the pivots *q* being points of suspension.

The stuff to be washed, is placed in the chest *a*, into which a current of water runs. The ore, floated onwards by the water, is carried through a sieve on a small sloping table *x*, under which is concealed the higher end of the movable table *d*, *b*, *c*, *u*; and it thence falls on this table, diffusing itself uniformly over its surface. The particles deposited on this table form an oblong *talus* (slope) upon it; the successive percussions that it receives, determine the weightier matters, and consequently those richest in metal, to accumulate towards its upper end at *u*. Now the workman by means of the lever *p*, raises the lower end *d* a little in order to preserve the same degree of inclination to the surface on which the deposit is strewed. According as the substances are swept along by the water, he is careful to remove them from the middle of the table towards the top, by means of a wooden rake. With this intent, he walks on the table *d b c u*, where the sandy sediment has sufficient consistence to bear him. When the table is abundantly charged with the washed ore, the deposit is divided into three bands or segments *d b*, *b e*, *c u*. Each of these bands is removed separately and thrown into the particular heap assigned to it. Every one of the heaps thus formed becomes afterwards the object of a separate manipulation on a percussion table, but always according to the same procedure. It is sufficient in general to pass twice over this table the matters contained in the heap, proceeding from the superior band *c u*, in order to obtain a pure *scalich*; but the heap proceeding from the intermediate belt *b e*, requires always a greater number of manipulations, and the lower band *d b* still more. These successive manipulations are so associated that eventually each heap furnishes pure *schlich*, which is

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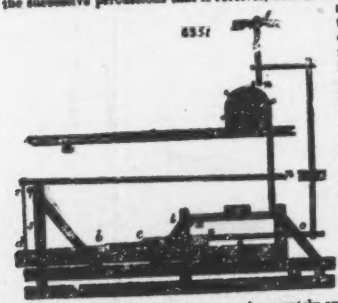

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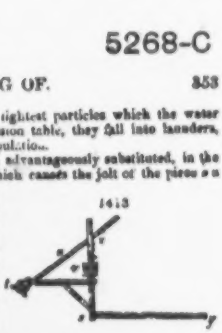
obtained from the superior band *c u*. As to the lightest particles which the water sweeps away beyond the lower end of the percussion table, they fall into launders, whence they are removed to undergo a new manipulation.

Fig. 1413 is a profile of a plan which has been advantageously substituted, in the Harz, for that part of the preceding apparatus which causes the jolt of the piece *o u* against the table *d b c u*. By means of this plan, it is easy to vary, according to the circumstances of a manipulation always delicate, the force of percussion which a bar *x y*, ought to communicate by its extremity *y*. With this view a slender piece of wood *u* is made to slide in an upright piece, *v x*, adjusted upon an axis at *v*. To the piece *u* a rod of iron is connected, by means of a hinge *x*; this rod is capable of entering more or less into a case or sheath in the middle of the piece *v x*, and of being stopped at the proper point, by a thumb-screw which presses against this piece. If it be wished to increase the force of percussion, we must lower the point *x*; if to diminish it, we must raise it. In the first case, the extremity of the piece , advances so much further under the cam of the driving shaft *t*; in the second, it goes so much less forwards; thus the adjustment is produced.

1413



The water for washing the ores is sometimes spread in slender streamlets, sometimes in a full body, so as to let two cubic feet escape per minute. The number of shocks communicated per minute, varies from 15 to 36; and the table may be pushed out of its settled position at one time three quarters of an inch, at another nearly 3 inches. The coarse ore-sand requires in general less water, and less slope of table, than the fine and pasty sand.

The following remarks on the Freiberg *shaking table*, are by Mr. Upfield Green, of the Wildberg Mines, Prussia. The bed of the table is about fourteen feet long, by six feet wide, and is formed of double one-inch boards, fastened to a strong frame. The table is hung by four chains, the two hindermost are generally two feet long with an inclination of 2 to 4 inches. The two front ones, which are attached to a roller for the purpose of altering the inclination of the table, are five feet six inches long, and hang perpendicularly when the table is at rest.

The table receives its action from cams inserted in the axle of a water-wheel, acting on the knee of a bent lever. The slimes after being thoroughly stirred up by a tormentor, are conveyed by a launder in a box, where they are still further diluted with clean water, and passing through a sieve with apertures corresponding to the size of the grain to be dressed, flow upon an inclined plane furnished with diffusing buttons, and from thence drip on to the shaking table.

In tressing rough slimes the two hindermost chains are set at an inclination of 5 to 6 inches, and the table with an inclination of 4 to 6 inches on its length, makes 36 to 39 pulsations of 5 to 6 inches in length per minute. About 2½ cubic feet of diluted slimes, twelve of clean to one of slime-water, enter the table per minute.

Before commencing the percussive action, the table is covered with a thin layer of rough slimes, and during the first few minutes only clean water is admitted. In consequence of the quantity of water and violent motion employed, the smaller and lighter particles of ore are likely to drift down the table, and a rake is therefore employed at intervals to reconvey such particles towards the head of the table. Care must, however, be taken not to allow the water to wear furrows in the deposit. From two to three hours are usually required for the roughest sand-slimes to deposit four to five inches on the head of the table. The crops are twice more passed over the shaking table and afterwards dollied. The rapidity of movement and quantity of clean water increase with each operation. The tails of the first operation, which are considerably poorer than the original stuff, may be either thrown away, or once more passed over the table, when the crop will be fit for treatment along with a fresh quantity of original slime. The treatment of fine slimes is similar to that of the rough, with the exception that the inclination of the table, quantity of slime-water, proportion of clean water, and length of stroke, constantly decrease with the degree of fineness of the slime; and the number of strokes increase in proportion. In fact, for the finest slimes, the table has no greater inclination than one inch on its whole length, while the stroke, of which 35 to 45 per minute are made, is no longer than ¼ to ½ an inch. The time required for dressing varies with the nature of the slime operated on, five tons of rough slimes occupies sixty-eight hours, whilst the same quantity of very fine slimes requires no less than four times that period.

The Stossherds.—To the kindness of Mr. Charles Rowtry, of Freiberg, I am indebted for the elevation of a stossherd erected at the Brelaigerberg Mines, near

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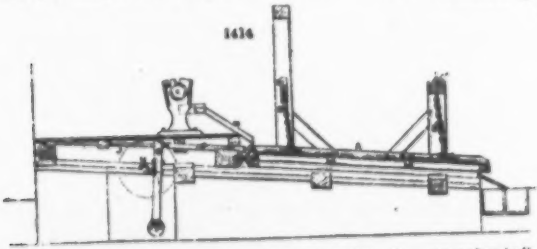
less management. It has the merit of being extremely light, requiring little power, and of performing its work in a highly satisfactory manner. *Fig.* 1414, *a*, table swung

1414



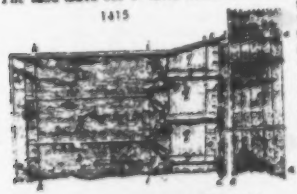
by chains, *b* *b*, its width being 3 feet and length 12 feet. A greater or less inclination is given to the table by raising or lowering the screws *c c*. At the upper end of the table is a buffer, *d*, which acts against a counter buffer, *e*. A sliding bar, *f*, is also fitted between the table and percussion lever *g*. This lever is struck by cams fitted on the axis *h*, driven by the runner *k*. The slimes to be treated flow into the cistern *i*, 30 inches long, 13 inches wide, and 18 inches deep. Into this box a tormentor is introduced for the purpose of breaking up the slimes. The bottom is fitted with a launder, *l*, 7 inches long, and 5 inches wide. From this launder proceeds a bead-board, *m*, expanded to the width of the table, and fitted with buttons, for the purpose of dispersing the slimes equally on the head of the table.

At the Freisigerberg mines the slimes are very fine and tough, and not rich in metal. With the round buddle unimportant results were obtained; but the stoneheard concentrated them satisfactorily. About five tons of rough slime are enriched per day on four tables, whilst from nine to ten tons of the enriched slime are despatched in a similar period.

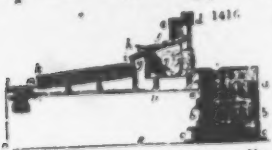
The four tables are managed by two boys, at a cost of 1*s.* 2*d.* per day. The cost of three washings complete, including water-wheel, 9 feet diameter, and 3 feet in breast, was 11*d*.

Sleeping tables. — *Figs* 1415, 1416, represent a complete system of *sleeping tables, tables dormantes*, such as are mounted at Idria. *Fig* 1415 is the plan, and *fig* 1416 a vertical section. The ores, reduced to a sand by stamps, pass into a series of conduits, *a a*, *b b*, *c c*, which form three successive floors below the level of the floor of the works. The sand taken out of these conduits is thrown into the cells *q*, whence they are

1415



1416



transferred into the trough *a*, and water is run upon them by turning two stop-cocks for each trough. The sand thus diffused upon each table, runs off with the water by a groove *f*, comes upon a sieve *h*, and spreads itself upon the board *q*, and thence falls into the slanting chest or sleeping table *i k*. The under surface *k* of this chest, is pierced with holes, which may be stopped at pleasure with wooden plugs. There is a conduit *m*, at the lower end of each table to catch the light particles carried off by the water out of the chest *i k*, through the holes properly opened, while the denser parts are deposited upon the bottom of the chest. A general conduit *n*, passes across at the foot of all the chests, *i k*, and receives the refuse of the washing operations.

In certain mines of the Harz, tables called *à bahut*, or *sweeping tables*, are employed. The whole of the

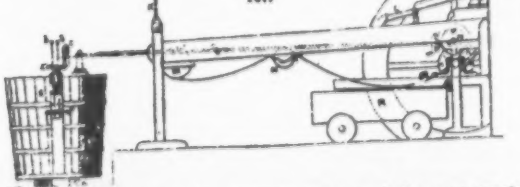
vehicles occasion in letting flow, over the sloping table, in successive currents, water charged with the ore, which is deposited at a less or greater distance, as also pure water for the purpose of washing the deposited ore, afterwards carried off by means of this operation.

At the upper end of these *sweeping-tables*, the matters for washing are agitated in a chest, by a small wheel with vanes, or flap-boards. The conduit of the muddy waters opens above a little table or shelf; the conduit of pure water, which adjoins the preceding, opens below it. At the lower part of each of these tables, there is a transverse slit covered by a small door with hinges, opening outwardly, by falling back towards the foot of the table. The water spreading over the table, may at pleasure be let into this slit, by raising a bit of leather which is nailed to the table, so as to cover the small door when it is in the shut position; but when this is opened, the piece of leather then hangs down into it. Otherwise the water may be allowed to pass freely above the leather when the door is shut. The same thing may be done with a similar opening placed above the conduit. By means of these two slits, two distinct qualities of ardoise may be obtained, which are deposited into two distinct conduits or canals. The refuse of the operation is turned into another conduit, and afterwards into ulterior reservoirs, whence it is lifted out to undergo a new washing.

Brunton's machine.—This apparatus appears to be well adapted for the utilisation of the ore contained in very fine slimes. At Devon Great Consols it is extensively employed, not only to concentrate the viscid kind of slime sometimes found at the periphery of the round buddle, but also to dress the tops and middles resulting from the dollying operation.

The small water-wheel, shown in *fig.* 1417, is sufficient to drive six of these

1417



machines, viz. three on each side. Before the stuff is permitted to enter upon the revolving cloth, it is disintegrated by tormentors, and passed through a sizing trommel; it then flows over the head or dispersing board L, on to the cloth. This cloth revolves towards the stream on two axles, M and N, and is supported by a third roller R. It is also stiffened in its width by numerous laths of wood. Clean water is introduced behind the entrance of the slime, in order to give it the proper consistency. Different degrees of inclination are given to the cloth by raising or lowering the roller R, by means of the screw S. The heavier particles lodged on the cloth are caught in the waggon B, whilst the lighter matter is floated over the roller R. The following particulars are furnished by Captain Isaac Richards, of Devon Great Consols:—

One revolution of the cloth is made in 6½ minutes; its length is about 29½ feet, so that it travels nearly 4½ feet per minute. Its width is four feet two inches.

Before the slime comes upon the cloth it is reduced to a size of $\frac{1}{40}$ of an inch, and yields an average of 1½ of copper; but by means of this machine the stuff is concentrated so as to afford 3 per cent. In ten hours it will clean 1½ tons, at a cost of 1s. per ton. The speed of the cloth must, however, be varied with the condition of the stuff; if it be very poor the cloth must travel very much slower, since the enrichment requires a longer period of time.

At the end of the machine, and worked by the same water-wheel, is a dolly tub; but the dimensions and mode of working this apparatus are fully stated page 356.

Bradford's slime apparatus, fig. 1418, has been extensively employed at the Bristol Mines, situated in Connecticut, United States.

Its action is intended to imitate that of the vanning shovel. The slime enters by the launder A, about 5 inches wide, and descends on the inclined head A, which expands from the width of the launder to within a few inches of the width of the table

5268-F

affords very little natural fall. In such cases the enrichment of ores becomes very expensive from the necessity of shifting some of the various products by manual labour, and of introducing lifting appliances in order to procure the requisite elevations for carrying out the various elaborative processes. It is, moreover, generally practicable from the configuration of the ground to form useful reservoirs of water within a reasonable distance; neither does it commonly occur in such cases that a free supply can be obtained for washing.

The pumping engine is therefore required to furnish the requisite quantity of water. This is generally conveyed over the floors by wood launders, often interfering with each other and obstructing the direct circulation of carts, railways, &c. Now if a stand-pipe or pressure column were erected at the engine, and a main judiciously laid throughout the floors, it is obvious that it would not only remedy this evil, but also afford water for the several washing purposes, as well as motive power for common, dash, or other wheels, together with turbines, flap jacks, &c.

1429

When an inconsiderable proportion of water has only to be raised to a higher level the common shoe or chain-pump will be found to render effective service; but when a larger stream is required it would be better to employ the rotary pump. This pump, fig. 1429, has been brought to great perfection by Messrs. Gwynne; A is the suction-pipe, and B the discharge, the dotted lines showing the discharge B, horizontal when required.

Pumps of the following dimensions are stated to raise and discharge per minute for a medium lift, say from 10 to 70 feet high:—

Diameter of discharge-pipe.	Diameter of suction-pipe.	Gallons of water per minute.
1½ inches.	2 inches.	35
3 "	4 "	70
4 "	5 "	150
5 "	6 "	300
6 "	7 "	500
7 "	8 "	1400

Stuff consisting of slimes and sand may be readily elevated by means of a Jacob's ladder or the Archimedean screw, illustrated at page 437, Vol. I fig. 543. For short elevations combined water and ruff wheels devised by Mr. Charles Bromley of Stolberg, Prussia, may be advantageously employed.

Fig. 1430, A, water-wheel; B, ruff or inverted wheel; C, axis of both ruff and water wheels, carrying a tooth driving wheel; D, sieving trommel; E, launder for inlet of stuff;

1430

F, discharge launder; G, sheet delivering water and ruff to launder E; H, stream receiving slime from trommel.

Slime pits.—In the several operations of cleansing ores from coal, in grinding, and washing, where a stream of water is used, it is impossible to prevent some of the finely attenuated portions floating in the water from being carried off with it

5268-G

Slime pits or *lodgements*, called *buddle holes* in Derbyshire, are employed to subject that matter, by receiving the water to settle at a little distance from the places of agitation.

These basins or reservoirs are of various dimensions, and from 24 to 40 inches deep. When the suspended ore is deposited, and nothing but clear water is allowed to escape.

The workmen employed in the mechanical preparation of the ores are paid, in Cumberland, by the piece, and not by day's wages. A certain quantity of crude ore is delivered to them, and their work is valued by the *bing*, a measure containing 14 cwt. of ore ready for smelting. The price varies according to the richness of the ore. Certain quantities are washed at the rate of 8s. 6d., or 1l. the bing; while others are worth at least 10s. The richness of the ore varies from 5 to 90 bings of galena per *shift* of ore; the shift corresponding to 8 waggon loads.

It is not essential to describe the dressing routine observable in any particular mine, since it is scarcely possible to observe the same system in any two distinct concerns. In the various modes of treatment, however, it may be remarked that the two leading features will always be *reduction* to a proper size and separation of the ore from the refuse. Until the ore is small previous to the crusher or stamps, the labour is chiefly one of picking and selecting, but from these machines usually commences a long series of divisions, sub-divisions, selections, and rejections. To follow these out in their various combinations would not only exceed the limits of this paper, but would perhaps be misunderstood by those not intimately acquainted with the subject.—J. D.

ORKHIE, a new brass, is the name given by MM. Mentier and Valiere, of Paris, to an alloy which has a golden brilliancy.

Copper	100	Sal ammoniac	9·6
Zinc	17	Quicklime	1·6
Magnesia	6	Tartar of commerce	9

The copper is first melted and then the other things are added, by small portions at a time, skimming and keeping in fusion for about half an hour.

The metal has a fine grain, malleable, takes a most brilliant polish, and has its complexion restored by the use of acidulated water. This brass melts at a comparatively low temperature. The zinc replaced by tin gives an alloy of greater brilliancy.

ORIENTAL AMETHYST. The name given to the violet or lilac-blue variety of sapphire. It forms the passage between that gem and the ruby.

ORIENTAL EMERALD. The name given to green sapphire.

ORIENTAL TOPAZ. The name given to yellow sapphire.

OR-MOLU. A brass which there is less zinc and more copper than in the ordinary brass; the object being to obtain a nearer imitation of gold than ordinary brass affords. In many of its applications the colour is heightened by means of a gold lacquer, but in some cases, and as we think with very great advantage, the true colour of the alloy is preserved after it has been properly developed by means of dilute sulphuric acid.

ORPIMENT (Eng. and Fr.) *Yellow sulphide of arsenic*; *Operment*; *Rauschgelb*, Germ.), is found native in many parts of the world; in Hungary, Turkey, China, &c.; the finest specimens being brought from Persia, in brilliant yellow masses, of a lamellar texture, called *golden orpiment*.

Native orpiment is the *auripigmentum*, or *paint of gold*, of the ancients. It was so called in allusion to its use and its colour, and also because it was supposed to contain gold. From this term, the common name of "*orpiment*," or "*gold paint*," has been derived.

In nature it is found most generally in amorphous masses of a bright yellow colour, but sometimes in crystals, which are oblique rhombic prisms; these crystals are flexible, of a yellow colour, and possess a brilliant lustre.

Native orpiment has a specific gravity of about 3·48. Orpiment is also prepared artificially, chiefly in Saxony, by subliming in cast-iron cucurbits, surmounted by conical cast-iron capitals, a mixture in due proportions of sulphur and arsenious acid. As thus obtained, it is in yellow compact opaque masses, of a glassy aspect; yielding a powder of a pale yellow colour.

Artificial orpiment seems to be a substance of uncertain composition, containing sometimes, according to Guibourt, 94 per cent. of arsenious acid, and only 6 per cent. of the tersulphide of arsenic. On this account it is much more soluble in water than the native orpiment, and consequently a much more powerful poison. It has been administered several times with criminal intentions, and in many of the cases proved fatal. Orpiment is the colouring matter of the pigment called king's yellow, which is a mixture of arsenious with a little tersulphide of arsenic, just as the sample analysed by Guibourt.

A proper tersulphide of arsenic may be obtained by passing a stream of sulphuretted

[Second Edition.]

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Date of Application, 3rd May, 1910

Complete Specification Left, 25th Nov., 1910—Accepted, 16th Feb., 1911

PROVISIONAL SPECIFICATION

Improvements in or relating to Ore Concentration.

We, THEODORE JESSE HOOVER, Metallurgist and Consulting Engineer, and MINERALS SEPARATION LIMITED, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,788/1902 describes a process of ore concentration which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type

According to this invention the method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles consists in bringing the ore pulp into contact with a porous medium through which air or other gas is caused to pass. Thus according to one method the pulp is introduced into a vessel having one or more porous walls through which air or other gas can be caused to pass.

The porous media employed according to this invention may consist of plates of porous ceramic material, porous brick, coke, or felt or other fibrous material suitably supported

The gas which is caused to pass through the porous medium into the ore pulp may be air, or furnace gases or it may be a gas produced chemically such as carbonic acid liberated from a carbonate or the gas may be produced electrolytically, or the gas which is passed through the porous medium may act both as selective agent and as frothing agent; a gas such as formaldehyde or carbon bisulphide vapour can be thus employed. The introduction of the gas through the porous medium may be effected either by pressure or by suction.

This invention is applicable in conjunction with various processes of ore concentration and a number of different means can be employed for carrying the invention into effect. For example, after agitating an ore pulp with an oil in such a way as to agglomerate metalliferous particles into granules according to the British Patents Nos. 26,295/1902, 17,109/1903 and 18,589/1903, the pulp containing the granules and also unoiled particles can in any suitable vessel be brought into contact with a porous medium through which air or gas is caused to pass in minute bubbles or streams whereby the granules are carried to the surface of the pulp.

A number of ways are known for treating an ore pulp to facilitate or to render possible the selective flotation of certain constituent particles in the form of a gaseous froth, see for example the processes described in Patents Nos. 12,778/1902, 7803/1905, 28,173/1908 and 2359/1909 The present invention may be used in conjunction with any such processes, that is to say, the

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N° 10,929 A.D. 1910

Improvements in or relating to Ore Concentration.

crushed ore may be mixed in any convenient way with water with or without an acid in solution and with or without an immiscible frothing agent such as oil or soluble frothing agent such as amyl-alcohol, and the pulp may be used at any temperature found suitable.

In one method of carrying this invention into effect a pulp of the kind described is passed intermittently or continuously into a vessel having one or more porous walls behind which a gas such as air is supplied under pressure so that the gas is forced through the porous diaphragm and in the form of minute bubbles is disseminated throughout the ore pulp. This method of introducing the gas may have three functions. The gas may bring about the necessary agitation of the pulp. The gas being in the state of very fine division is effectively brought into contact with every mineral particle. The fine bubbles of gas readily come to the surface of the pulp in the form of a froth.

Referring to the Patent No. 29,374/1904 the ore pulp is passed over a table on which flotation of the metalliferous particles takes place. According to this invention such a table may have a porous top through which air or other gas under pressure may be introduced into the pulp to effect the flotation of certain particles.

Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spitzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.

Apparatus for use according to this invention is conveniently continuous in operation. Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention.

Dated this 3rd day of May, 1910.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in or relating to Ore Concentration.

We, THEODORE JESSE HOOVER, Metallurgist and Consulting Engineer, and MINERALS SEPARATION LIMITED, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,778 of 1902 describes a process of ore concentration

Improvements in or relating to Ore Concentration.

which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type.

According to this invention the method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles consists in bringing the ore pulp into contact with a porous medium through which air or other gas is caused to pass. Thus according to one method the pulp is introduced into a vessel having one or more porous walls through which air or other gas can be caused to pass.

The porous media employed according to this invention may consist of plates of porous ceramic material, porous brick, coke, or felt or other fibrous material suitably supported.

The gas which is caused to pass through the porous medium into the ore pulp may be air, or furnace gases or it may be a gas produced chemically such as carbonic acid liberated from a carbonate or the gas may be produced electrolytically, or the gas which is passed through the porous medium may act both as selective agent and as frothing agent: a gas such as formaldehyde or carbon bisulphide vapour can be thus employed. The introduction of the gas through the porous medium may be effected either by pressure or by suction.

This invention is applicable in conjunction with various processes of ore concentration and a number of different means can be employed for carrying the invention into effect. For example, after agitating an ore pulp with an oil in such a way as to agglomerate metalliferous particles into granules according to the British Patents Nos. 26,295/1902, 17,109/1903 and 18,589/1903, the pulp containing the granules and also unoiled particles can in any suitable vessel be brought into contact with a porous medium through which air or gas is caused to pass in minute bubbles or streams whereby the granules are carried to the surface of the pulp.

A number of ways are known for treating an ore pulp to facilitate or to render possible the selective flotation of certain constituent particles in the form of a gaseous froth, see for example the processes described in Patents Nos. 12,778/1902, 7803/1905, 28,173/1908 and 2359/1909. The present invention may be used in conjunction with any such processes, that is to say, the crushed ore may be mixed in any convenient way with water with or without an acid in solution and with or without an immiscible frothing agent such as oil or soluble frothing agent such as amyl-alcohol; and the pulp may be used at any temperature found suitable.

In one method of carrying this invention into effect a pulp of the kind described is passed intermittently or continuously into a vessel having one or more porous walls behind which a gas such as air is supplied under pressure so that the gas is forced through the porous diaphragm and in the form of minute bubbles is disseminated throughout the ore pulp. This method of introducing the gas may have three functions. The gas may bring about the necessary agitation of the pulp. The gas being in the state of very fine division is effectively brought into contact with every mineral particle. The fine bubbles of gas readily come to the surface of the pulp in the form of a froth.

Referring to the Patent No. 29,374/1904 the ore pulp is passed over a table on which flotation of the metalliferous particles takes place. According to this invention such a table may have a porous top through which air or other gas under pressure may be introduced into the pulp to effect the flotation of certain particles.

Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spitzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.

Apparatus for use according to this invention is conveniently continuous in

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N° 10,929—A.D. 1910.

Improvements in or relating to Ore Concentration.

operation. Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself, by any of the well known methods for obtaining a supply of compressed air by the fall or flow of a liquid.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in bringing the ore pulp into contact with a porous medium through which the air or other gas is caused to pass.

2. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in introducing the pulp into a vessel having one or more porous walls through which air or other gas can be caused to pass.

3. The method of concentrating ores which consists in mixing the crushed ore with water and with a mineral-frothing agent and introducing air or other gas into the pulp through a porous medium adapted to subdivide the gas into extremely fine streams or bubbles.

4. The method of concentrating ores which consists in agitating the ore pulp with a mineral-frothing agent and passing the pulp over a table having a porous top or over a trough having a porous bottom through which porous parts air or other gas under pressure is introduced into the pulp to effect flotation of certain particles.

5. Apparatus for introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain mineral particles which comprises a porous surface (for example the wall or walls of a containing vessel, the surface of a flotation table or a duct) with which the ore pulp comes into contact at one period of its treatment, and through which air or other gas may be forced or drawn into the pulp.

6. Apparatus substantially as described, for introducing air or other gas into an ore pulp for the purpose of effecting the flotation of certain mineral particles.

Dated this 23rd day of November, 1910.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

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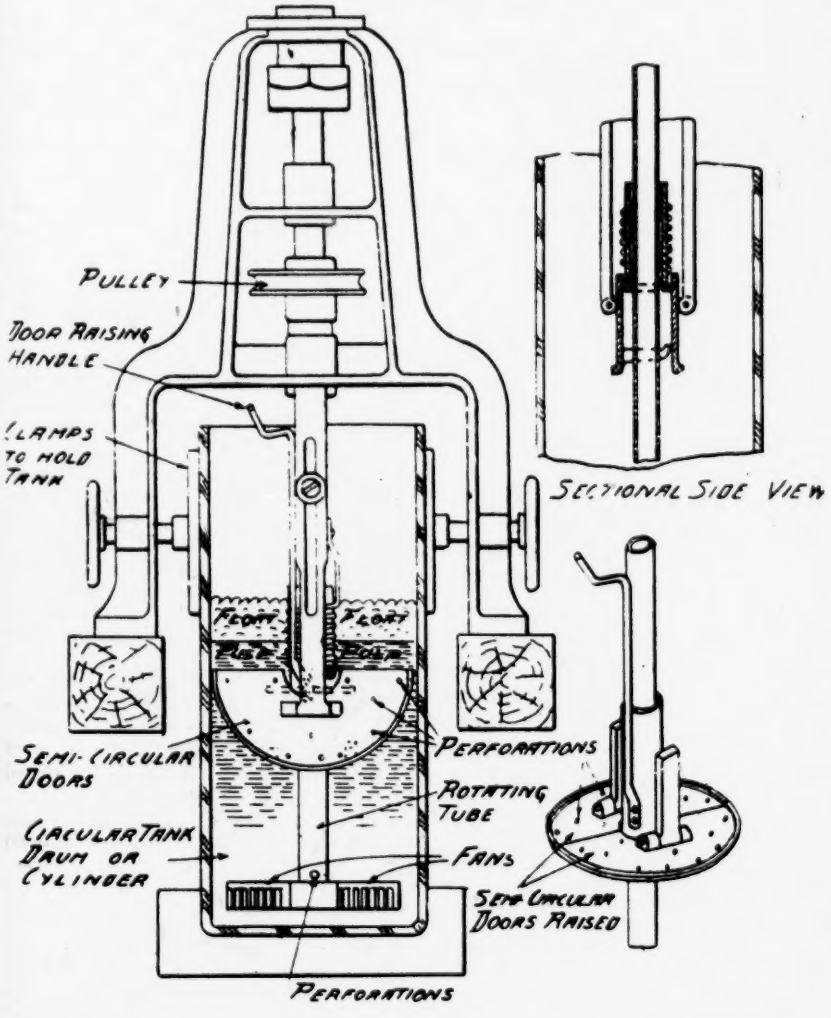
5273

Defendant's Exhibit No. 217.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

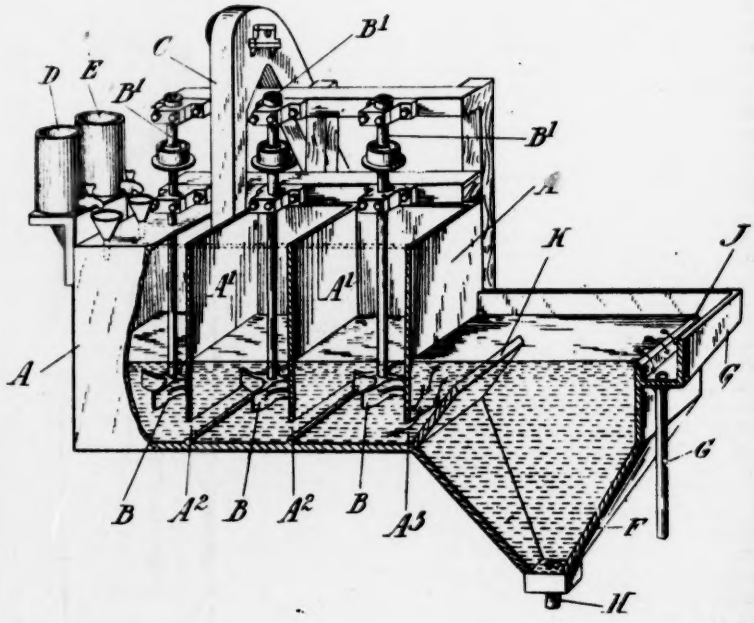
Defendant's Exhibit No. 218.

H. L. SULMAN, H. H. GREENWAY & A. H. HIGGINS.

ORE CONCENTRATION.

APPLICATION FILED APR. 30, 1909.

962,678. **Patented June 28, 1910.**



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Henry Howard Greenway and
Arthur Howard Higgins
By
Knight Bros.
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UNITED STATES PATENT OFFICE.

HENRY LIVINGSTONE SULMAN, HENRY HOWARD GREENWAY, AND ARTHUR HOWARD HIGGINS OF LONDON, ENGLAND.

ORE CONCENTRATION.

962,678. Specification of Letters Patent. Patented June 28, 1910.

Application filed April 30, 1909. Serial No. 493,207.

To all whom it may concern.

Be it known that we, HENRY LIVINGSTONE SULMAN, HENRY HOWARD GREENWAY, and ARTHUR HOWARD HIGGINS, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in Ore Concentration, of which the following is a specification.

This invention relates to the concentration of ores, the object being to separate certain constituents of an ore such as metallic sulfids from other constituents such as gangue when the ore is suspended in a liquid such as water.

According to this invention the crushed ore is mixed with water containing in solution a small percentage of a mineral-frothing agent, (that is of one or more organic substances which enable metallic sulfids to float under conditions hereinafter specified) and containing also a small percentage of a suitable acid such as sulfuric acid, and the mixture is thoroughly agitated; a gas is liberated in, generated in, or effectively introduced into the mixture and the ore particles come in contact with the gas and the result is that metallic sulfid particles float to the surface in the form of a froth or scum, and can thereafter be separated by any well known means. Among the organic substances which in solution we have found suitable for use as mineral-frothing agents with certain ores are amyl acetate and other esters; phenol and its homologues; benzoic, valerianic and lactic acids; acetones and other ketones such as camphor. In some cases a mixture of two such mineral-frothing agents gives a better result than a single agent. The above mentioned mineral-frothing agents are all more or less effective in the presence of an acid such as sulfuric acid and are given as types but are not intended to form an exhaustive list of suitable organic substances which may be used in this manner and for these objects. On the other hand there are many organic compounds which in solution will not effect the result described, such as some sugars, dextrin, saponin, albumen, ox gall, etc., and a simple test is required in the case of varying ores or materials to determine which organic compound is most suitable.

The following is an example of one method of carrying this invention into effect:—Water containing a small percentage of sulfuric acid in solution, say from 2% to 0.5%, and containing in solution a small quantity say 0.1% of one of the foregoing organic substances (say amyl acetate) is, with finely pulverized ore, introduced into an agitating apparatus, in the proportion of say 3 parts by weight of water to 1 part by weight of ore. The agitation is carried out in such a way as thoroughly to disseminate air through the mixture which is thereafter discharged into a spitzkasten. It is found that a coherent froth or scum floats on the surface of the water in the spitzkasten. This froth contains a large proportion of the metallic sulfids but is substantially free from gangue. Any well known means may be employed for collecting the froth. If desired the tailings can be re-treated by the same process with or without the addition of fresh quantities of the organic materials referred to. The action may in some instances be improved by heating the mixture.

The accompanying drawing is a diagrammatic view in perspective illustrating one form of apparatus partly broken away suitable for use in this process. (The apparatus itself forms no part of this invention.)

Several agitation vessels A are placed in series. These may conveniently be large vats separated by partitions A^1 having openings A^2 at the bottom so that the liquid may pass from one to another. Each vessel is provided with a rotatable stirrer B which is conveniently of the form shown in the drawing. Each stirrer is carried on a spindle B^1 rotated at a high speed by any convenient means. Crushed ore or similar finely divided mineral is fed into the first vessel A through any convenient ore-feeding device such as C, and water is also fed into the vessel A. A small proportion of acid, such as sulfuric acid, may be introduced into the water from the feeding vessel D, and a small proportion of one or more other soluble substances which enable metallic sulfids to be floated by air under the conditions hereafter specified, may be introduced from the feeding vessel E. The liquid containing ore in suspension is vigorously agitated in the agitation-vessels and escapes at the outlet A^3 highly charged with air.

A settling apparatus consisting of one or

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more spitzkasten F, is placed immediately at the outlet from the agitation apparatus. As shown in the drawing, the spitzkasten F has a launder G to receive the floating froth which passes away through the outlet G^1. The liquid and the sunken material pass out through the outlet H at the bottom of the spitzkasten. The level of the liquid in the spitzkasten is slightly above the lip J. Within the spitzkasten is placed an inclined baffle or guide-plate K, which may be made adjustable, extending upward from below the inlet A^3 and arranged to direct the stream of ore-particles and air-bubbles toward the surface of the liquid in the spitzkasten.

Hitherto many proposals have been made for the wet concentration of ores involving the addition to the liquid in which the ore is suspended of an immiscible liquid. For example in the patent granted to Cattermole, Sulman & Picard, United States No. 777274 dated December 13th, 1904, is described a process of ore concentration in which metalliferous particles were coated with a thin film of a fatty or resin acid or a phenol or a cresol by introducing the alkaline compounds of these materials into an acid liquid whereby these materials were liberated in an immiscible or insoluble condition and adhered to the mineral particles. In another known process the powdered ore suspended in water, preferably acidified, is mechanically brought to the surface whereby the particles are exposed to the air and it is found that the metalliferous particles float on the surface while the gangue sinks. In this known process the selective flotation of the metalliferous particles is not due to the metalliferous particles being coated with a selective agent, that is to say, the selective flotation is due to the properties of the metalliferous particles themselves when exposed to air or other gas and brought onto the edge or surface of water preferably acidified.

The present process differs from the two before mentioned types and from other known concentration processes by the introduction into the acidified ore pulp of a small quantity of a mineral-frothing agent *i. e.*, an organic compound in solution of the kind above referred to and by the fact that the metalliferous particles are brought to the surface in the form of a froth or scum not by mechanical means but by the attachment of air or other gas bubbles thereto.

In the frothing processes hitherto known the substances used to secure the formation of a mineral-bearing froth has been oil or an oily liquid immiscible with water. According to this invention the mineral-frothing agent consists of an organic compound contained in solution in the acidified water.

We do not confine ourselves to the proportions above given, the best proportion can in each case be easily determined by trial.

It is well known that certain of the organic substances we have referred to are not soluble in water in all proportions and that if used in excess might partly remain insoluble in the acidified water and might become mechanically affixed to the metalliferous particles of the ore. We disclaim any such use of these substances and only claim them in such amount as will enable them to dissolve in the acidified water.

What we claim as our invention and desire to secure by Letters Patent is:—

1. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

2. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

3. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

4. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

5. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form froth and separating the froth.

6. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

7. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

8. The hereindescribed process of concentrating ores which consists in mixing the

powdered ore with slightly acidified water containing in solution a small quantity of ab organic mineral-frothing agent, heating the mixture, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

9. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of an organic amyl compound, agitating the mixture to form a froth and separating the froth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN
H. HOWARD GREENWAY.
ARTHUR HOWARD HIGGINS.

Witnesses.
WALTER J. SKERTEN.
E C. WALKER.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

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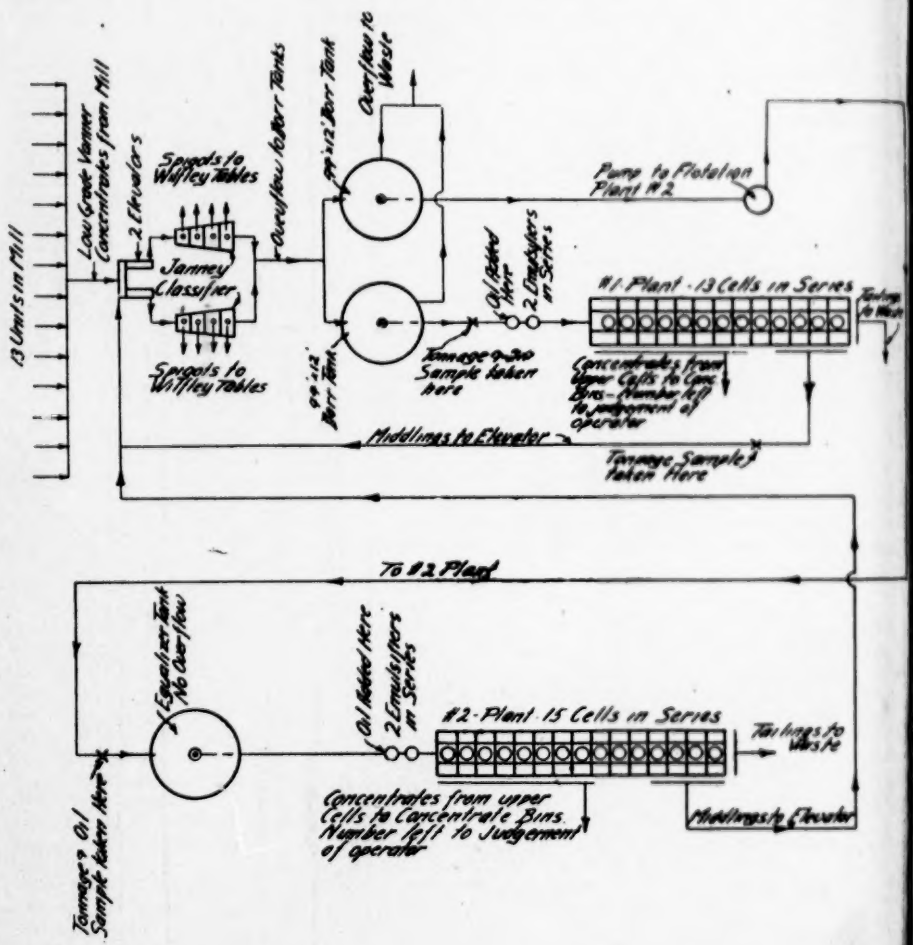
5278

Defendant's Exhibit No. 219.


13 Units in Mill
Low Grade Vanner Concentrates from Mill
2 Elevators
Spigots to Wilfley Tables
Janney Classifier
Spigots to Wilfley Tables
Overflow to Flotation Tanks
9'x12' Barr Tank
9'x12' Barr Tank
Overflow to Waste
Pump to Flotation Plant #2
Oil Added Here
2 Emulsifiers in Series
#1 Plant - 13 Cells in Series
Tailings to Waste
Tonnage & Sample taken here
Concentrates from Upper Cells to Conc. Bins - Number left to judgement of operator
Middlings to Elevator
Tonnage Sample taken Here
To #2 Plant
Equalizer Tank No Overflow
Oil Added Here
2 Emulsifiers in Series
#2 - Plant 15 Cells in Series
Tailings to Waste
Tonnage & Oil Sample taken Here
Concentrates from upper Cells to Concentrate Bins. Number left to Judgement of operator
Middlings to Elevator

FLOW SHEET FOR CONCENTRATE FLOTATION PLANT

ARTHUR PLANT — UTAH COPPER CO.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

9-21-17

5279 Defendant's Exhibit No. 220.

Utah Copper Company, Arthur Plant, Metallurgical Department.

Eight-hour Test Made in Retreatment Plant, Consisting of Two Emulsifiers and Thirteen Cells, Using 323.78 Pounds of Oil per Ton of Low-grade Concentrate.

Test Started April 29, at 5:45 p. m., and Ended April 30, at 1:45 a. m.

Results.

	Heading.	Tailing.	Concentrate.
Tonnage	91.3	64.1	27.2
Per cent copper (Note *a*)	5.25	.22	17.10
Per cent iron	.....	.....	16.00
Per cent insoluble	.....	.....	40.00
Pounds oil per ton by assay (Note *b*)	1.04	20.753	680.175
Pounds new oil per ton	322.74	.....	.....
Total pounds oil per ton	323.78	.....	.....
Total pounds oil used	29,560.95	.....	.....
Total pounds of oil computed from assays	94.95	1330.27	18,500.76
Ratio of concentration	3.356 into 1		
Per cent indicated copper extraction	97.058	.....	.....
Per cent solids in feed	18.03	.....	.....
Pounds alkaline reagent per ton	6.37	.....	.....

Kind of oil used—a mixture composed of 59% Fuel Oil, 30% Jones Oil, 10% American Creosote No. 2, and 1% Yaryan Pine Oil.

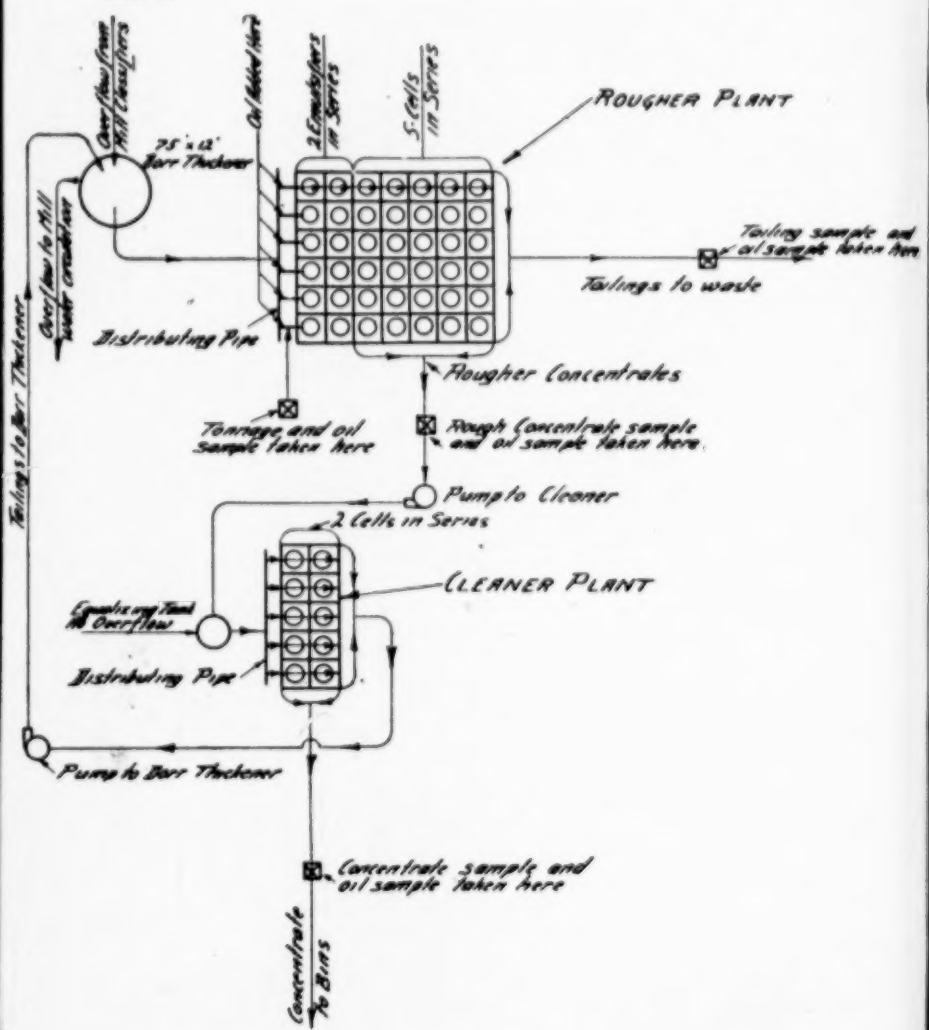
(*a*) On account of the products containing so much oil they were washed with an oil solvent before the metal assays were made.

(*b*) These figures represent the amount of oil per ton of original material treated and the resultant products.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 221.

5280-81


Overflow from Hill Classifiers
Oil Added Here
2 Conditioners in Series
5 Cells in Series
ROUGHER PLANT
75' x 12' Barr Thickener
Overflow to Hill Gentle Conditioner
Tailings to Barr Thickener
Distributing Pipe
Tailing sample and oil sample taken here
Tailings to waste
Rougher Concentrates
Tonnage and oil sample taken here
Rough Concentrate sample and oil sample taken here
Pump to Cleaner
2 Cells in Series
CLEANER PLANT
Overflow and Final Tail Overflow
Distributing Pipe
Pump to Barr Thickener
Concentrate sample and oil sample taken here
Concentrate to Bins

FLOW SHEET FOR SLIME FLOTATION PLANT

ARTHUR PLANT UTAH COPPER CO.

9-21-17

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Defendant's Exhibits Nos. 222, 223 and 224, marked pages 5282-87, inclusive.)

5290 Defendant's Exhibit No. 227.

Butte, Montana, May 5th, 1917.

Mr. J. L. Bruce, Manager, Plant.

DEAR SIR: Attached hereto tabulated sheets showing results of samples taken from 1:00 to 5:00 P. M., Sunday, April 29th at which time representatives of the Mineral Separation Company and representatives of the Butte & Superior Mining Company were present during the time all samples were taken, placed in containers, and marked, also copy of letter from Edward Walser, Chief Chemist, R. B. Stringfield, Oil Chemist and T. R. Featherly, Head Sampler, describing the manner in which all samples were handled. I was present during the entire period when the samples were taken.

Flotation Head, Flotation Concentrate and General Mill tailings samples were taken from the automatic samplers, cutting every 7½ minutes. Alternating cuts were turned over to representatives of the Minerals Separation Company and page No. 3 is analyses of the other alternating cuts retained by our representatives. Hand samples were taken of the first, second and third Spitz on the North side of the No. 5 Pyramid machine and the South side of the No. 6 Pyramid machine, which I consider fairly represents the Rougher concentrates. Samples were taken from the Nos. 4, 5, 6, and
5291 7 Spitz of the same machines, which would fairly represent the middlings returned from the Roughing machines. These samples do not include the first and second cleaner tailings, which were also returned to the head of the machines as middlings. Grab samples were taken of the crude ore from the mine bin, the Mill Heads at the Tripper, the discharge product from Tube Mills Nos. 2 and 3, Section 2, and Spigot products from 40′ and 50′ Settling tanks. The last two samples cannot be considered representative of regular operations as they were only grab samples. Sample of the Nos. 1, 2 and 3 cleaner tailings were also grab samples and cannot be considered representative of regular operations.

Yours very truly,

J. T. SHIMMIN,
Mill Superintendent.

J. T. S.—J. D. S.

5292 Sheet No. 1.

Butte & Superior Mining Company.

Special Report of Flotation Operation 1.00 *to* 5.00 *p. m.*, 4/29/17.

Oils.

Name.	% of total.	Pounds per min.	Lbs. for four hours.	†Specific gravity.
Standard Yaryan Pine	24.30	7.035	1689	.9050
Fuel Oil	64.47	18.664	4479	.5860
Commercial Kerosene	11.23	3.251	780	.8195
Mixture	100.00	28.950	6948	.8821

Other Reagents.

Name.	ccs. per min.	Lbs. for four hours.	Specific gravity.
Sulphuric Acid to Distributor.....	1497.8	1865	1.705
" " " Slimes	571.0		
Copper Sulphate to Distributor.....	2452.8	1712	1.321

Period of Operation.....Four hours
Flotation feed tonnage for four hours.....263.53 dry tons
Flotation concentrates produced.....60.16 dry tons
Temperature of feed .....Atmospheric
Dilution of feed.....3.45 :: 1

Oils and Reagents Used.

Pine oil lb./ton.	Fuel oil lb./ton.	Commercial kerosene lb./ton.	Sulphuric acid lb./ton.	Copper sulphate A. C. M. solution lb./ton.
6.41	17.00	2.96	7.08	(*a*) 6.50

(*a*) Equivalent to 0.10 pounds metallic copper per ton.

Metallic copper consumed..... 26.022 pounds
Actual initial oil added per ton..... 26.37 "

NOTE—†Specific Gravity of oil reagents was determined on the samples taken during this test.

The assay results and oil analyses for this period are as follows:

Flotation Feed Including—

	Circulating lead.		Tailing.		Concentrate.	
	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.
1-5 P. M.....	12.6	1.77	1.57	0.67	45.2	3.13

Apparent Recovery—89.58% (Figured from theoretical flotation feed).

5293 Sheet No. 2.

Butte & Superior Mining Company.

Notes to Accompany Sheet No. 1.

% of Total Oil—

Inventory for 4/29/17 showed:

Lbs. Standard Yaryan Pine used..... 8,844=24.30% of total
" Fuel Oil used.....23,467=64.47% of total
" Commercial Kerosene ..... 4,086=11.23% of total

Total oil used 36,397

Tonnages.

Mill Heads (24 hours=1602 dry tons)

5 feeders on medium=48 R. P. Hour.....Factor .2926
5x48x4x.2926= .....280.9 dry tons

Mill Lead Concentrates (24 hrs.=7 dry tons)

$$\frac{\text{Mill Heads for 4 hours } 281}{\text{Mill Heads for 24 hours } 1602} = \frac{}{} = 0.1754$$

7x.1754= ..... 1.23 dry tons

Mill Zinc Concentrates (24 hrs.=92 dry tons)

92x.1754= .....16.14 dry tons

Flotation Concentrates (24 hrs.=343 dry tons)

343x.1754= .....60.16 dry tons

Flotation Feed

Mill Heads—(Mill Lead plus Zinc)=
280.9 — 17.37= .....263.53 dry tons

Assays.

Mill Lead Concentrates (11.95% Zn.)

1st shift=11.0% Zinc .....Mill Heads=491 tons
2nd shift=12.8% " ..... " " =554 "

$$\frac{491 \times 11.0 \text{ plus } 554 \times 12.8}{1045} = 11.95$$

Mill Zinc Concentrates (46.35% Zn.)

1st shift=45.5% Zinc
2nd " =47.1% "

$$\frac{45.5 \times 491 \text{ plus } 47.1 \times 554}{1045} = 46.35$$

Theoretical Flotation Feed (11.60 Zn.)

Mill Head tonnage x Zn. assay—(Mill Pb. tonnage x Zn. Assay plus Mill Zn. tonnage x Zn. Assay)

Flotation Feed Tonnage.

$$\frac{280.9 \times 13.6 - (1.23 \times 11.95 \text{ plus } 16.14 \times 46.35)}{263.53} = 11.60$$

Apparent Recovery (89.58%)

C=Flotation concentrate assay = 45.2 % Zn.
H=Flotation Feed assay (theoretical)= 11.60% Zn.
T=Mill Tailings assay = 1.57% Zn.

$$\frac{C\ (H-T)}{H\ (C-T)} = \frac{45.2\ (11.6-1.57)}{11.6\ (45.2-1.57)} = 89.58$$

PAGES MISN

Special Samples—Flotation Operation—1:00 to 5:00 P. M. April 29th, 1917.

Sample, Analyses, Oil and Dilutions.

Name.	Analysis. % Cu.	% Pb.	% Zn.	% Insol.	% Fe.	% Mn.	% Oil.	Dilution.	Taken by—
Flot. Feed No. 1 Bucket	...	...	11.15	...	...	...	1.57	4.0	
" " No. 2 "	...	...	12.1	...	...	...	1.17	3.5	
" " No. 3 "	...	...	12.3	...	...	...	1.60	3.7	
" " No. 4 "	...	...	13.5	...	...	...	1.80	2.5	J. W. L.
" " No. 5 "	...	...	13.5	...	...	...	2.03	3.6	C. K. B.
" " No. 6 "	...	...	13.2	...	...	...	1.72	3.6	
" " Composite	0.14	0.77	12.6	63.6	1.85	1.31	1.77	3.45	
Flot. Conc.—Finished pro.	0.57	3.35	45.2	19.0	2.78	0.40	3.13	3.0	C. F. W. J. W. D.
General Mill Tails No. 1 Bucket	...	...	1.40	...	...	...	.50	3.0	
" " " No. 2 "	...	...	1.71	...	...	...	.62	3.3	W. A. B. W.
" " " No. 3 "	...	...	1.76	...	...	...	.71	3.5	C. C. R.
" " " Composite	0.053	0.10	1.57	90.0	0.70	1.47	.67	3.26	H. J. S.
Rougher Conc. 1st Spitz	0.53	3.55	35.2	32.0	2.89	0.76	2.77	4.1	
" " 2nd "	0.55	2.70	35.4	33.2	2.89	0.70	2.56	3.6	
" " 3rd "	0.50	2.45	37.7	29.2	3.44	0.70	2.85	3.4	Wilding
Primary Midds.—4-7 Spitz	0.17	0.45	10.8	73.6	2.02	1.31	1.68	6.0	J. W. S.
" Tails	0.026	0.10	1.16	91.8	0.55	1.53	.35	2.3	
1st Cleaner Tails	...	...	16.70	...	...	...	2.18	6.4	
2nd " "	...	...	8.65	...	...	...	2.24	8.2	G. A. C.
3rd " "	...	...	12.35	...	...	...	2.74	10.4	A. W. H.
Slime Feed to Sludge Tank	0.14	0.88	13.6	70.4	1.36	1.36	...	2.4	
No. 4 Sec. 1 No. 1 Sec. 2—T. M. Dischg.	0.12	0.45	8.9	80.6	1.36	1.20	...	0.7	J. L. G.
Crude Ore taken from Bins	0.43	0.60	22.3	59.2	2.29	0.35	...	..	T. F.
Crude Ore taken from Tripper	0.23	1.13	16.1	67.0	2.18	0.94	...	..	

BUTTE & SUPR. MNG. CO. VS. MIN. SEP., LTD., ET AL. 2939

Special Samples—Flotation Operation—1:00 to 5:00 P. M., 4/29/17.

Samples Taken 4/29/17—1:00 to 5:00 P. M.

Name of Sample.	Samplers. M. S. Co.	Samplers. B. & S. Co.	Remarks.
General Mill Tailings	Walling	Riser Stiebel	3 buckets each party automatic sampler—7½ min.
Flotation Head Sample	Littleford	Bain	6 buckets each party automatic sampler—7½ min.
Flotation Concentrates	C. F. Williams	Dudgeon Hunter	1 bucket each party automatic sampler—7½ min.
No. 1 Spitz Rghr. Conc. S. Side No. 6 No. 2 " " " N. Side No. 5 No. 3 " " " ..... No. 4-7 " Midds. ..... Tails No. 5 Pryamid only.....	Wilding Pudan	Sheedy Burns	Hand samples every 30 minutes.
	Special Samplers.		
1st Cleaner Tails 3:10 P. M. ..... 2nd " " 3:15 P. M..... 3rd " " 3:20 P. M.....	Chapman	Hackwood	Grab sample—1 acid bottle. " " —1 " " " " —1 " "
No. 4 Tube Mill Sec. 1, No. 1 Tube..			Grab sample—1 acid bottle.

Mill Sec. 2—Discharge

Slime Feed to Sludge Tank.....	Greniger	Featherly	" " —1 " "
Crude Ore Sample from Tripper....			" " —Approx. 12 lbs.
Crude Ore Sample from Bins.....			" " — " " "
Cu SO4 & H2SO4 to Dist.....	Martin	Engleman	Measured every 15 minutes 125 cc. taken for sample each time.
Oils	Williams	Conrad Cornelius	Measured every 15 minutes 250 cc. taken for sample each time.
Individual Oils.....	Schultz	Hollister	
H2 SO4 to Slimes.....	Wilkinson	Lewis	Sampled from 3:00 P. M. to 5:00 P. M.

5296 Sheet No. 5.

Butte & Superior Mining Company.

Special Samples—Flotation Operation 1:00 to 5:00 p. m., 4/29/17.

General Method of Treating Samples After Arriving at the Sampling Department.

For Oil:—Samples consisting of more than one bucket:
1 cup from each bucket for separate oil analysis.
1 cup from each bucket for composite oil analysis.
Samples consisting of one bucket, one cup was taken for oil analysis.
Samples which had been put in an acid bottle were transferred to a bucket and one cup taken for oil analysis.
Dilution:—All samples excepting the crude ore from the tripper and the mill bins were weighed before and after drying.
For Assay:—Samples consisting of more than one bucket:
Dried contents of each bucket cut in halves.
One set of halves were combined for a composite sample.
Other set of halves assayed separately.
Samples consisting of one bucket:
Assay sample cut out.
Rejects:—All rejects saved and sacked.

J. D. S.

____ ____,
Mill Superintendent.

5297 May 1st, 1917.

Mr. J. T. Shimmin, Mill Superintendent, Plant.

DEAR SIR: On April 29th, 1917, representatives of the Mineral Separation Company Ltd., visited the Butte & Superior Mining Company's mill to take samples of various products in the flotation plant, and mill in general if so desired, and also to inspect the plant in general.

One or more of these visitors were escorted through the plant by a representative of the Butte & Superior Mining Company.

Samples were taken for a period of four hours, between the hours of 1:00 and 5:00 P. M. The flotation feed, concentrates and general mill tailings were taken by the automatic sampler, which cuts a sample every seven and one-half minutes. The primary tailings, middlings and rougher concentrates were taken by hand, every fifteen minutes.

Oil samples were taken of the plant mixture that was being used during the period of sampling to ascertain the amount of oil being used. A measurement was taken every fifteen minutes, which was

weighed out. Copper sulphate solution and sulphuric acid was sampled every fifteen minutes but was measured in cc.'s per minute.

Special samples were taken on the first, second and third cleaner tailings. But one sample was taken of these products and placed in acid bottles.

5298 Special samples were also taken of the slime feed to the sludge tank, discharge of No. 4 tube mill section 1, and No. 1 tube mill section 2.

A sample of mill feed was taken at the mill bins, on the tripper, and which was also taken by hand, and placed in a bottle. A sample of rock was taken from the mine bin, which was listed as a grab sample.

A representative of both companies was present at all times where samples were being taken. All samples were taken in duplicate, alternating cuts for each side so that both samples would be fair and representative.

At the close of the set time for sampling, all samples were turned into the sampling department, where the following method was used in drying and cutting down.

In every case where more than one bucket composed a sample each bucket was weighed and dried and a sample cut out for assay. Before being weighed an oil sample was taken. Each bucket sample was cut in half so a composite could be made up and an assay of the composite obtained.

Screen analyses were run on rejects of samples and on the composite sample of the flotation feed and general tailings. Screens will be run for weight of material and zinc.

All results of assays, weights, dilutions, oil and screen analyses will be reported under separate cover.

Yours truly,

T. R. FEATHERLY.

T. R. F.—J. D. S.

5299 May 2nd, 1917.

Mr. J. T. Shimmin, Mill Superintendent, Plant.

DEAR SIR: The following is the analytical procedure used in determining the percentages of oil in the various products from the test run made in co-operation with Minerals Separation representatives, Sunday April 29th, 1917, from 1:00 to 5:00 P. M. This procedure has been thoroughly tested in this laboratory and proven accurate for the oil mixtures used and conditions prevailing in this plant.

Analytical Procedure.

The wet sludge, as received from the sampling department, was thoroughly mixed and immediately thrown on wet filter paper contained in a Buchner funnel. Suction was then applied and the

water thoroughly drained; the resulting production containing from 10 to 15% moisture.

This product was removed from the filter paper as completely as possible, well mixed with a spatula, and duplicate samples, approximately two grams of dry substance each, placed in small porcelain crucibles, which were placed in a desiccator over dry calcium chloride. The desiccator was then sealed and allowed to remain at a temperature of about 20° Centigrade for fifteen hours, without opening. This has been proven to be sufficient time to completely dry the samples; the residue being dry ore and oil.

5300 These dry residues were transferred to tared alundum extraction thimbles, which were then accurately weighed, placed in Soxhlet extractors, and extracted with ether for one hour and fifteen minutes, thus removing all the oil present in the sample. The thimbles plus the oil-free ore were then removed, dried at about 40° Centigrade, cooled, and weighed; the loss in weight being considered as oil, and being calculated to percent in dry oil-free ore.

For example:—

Weight thimble plus ore plus oil (before extraction)	12.2970 gms.
Weight thimble plus ore (after extraction)	12.2720
Weight oil	.0250 gms.
Weight thimble plus ore (after extraction)	12.272 gms.
Weight thimble empty	10.216

$$\frac{\text{Weight Oil}}{\text{Weight dry ore}} = \frac{.0250}{2.056} = 1.22\% \text{ oil}$$

Very truly yours,

R. B. STRINGFIELD.

R. B. S./E. G. B.

Copy to: D. C. Jackling.
H. B. McKelvie.
J. L. Bruce.
W. A. Scott.
J. B. Kremer.
J. T. Shimmin.
B. H. Dosenbach.
Chas. Bocking.

5301 May 4th, 1917.

Mr. J. T. Shimmin, Mill Superintendent, Plant.

DEAR SIR: Our regular methods have been employed in determining the various metals and other constituents in the samples taken

during the test run made in conjunction with Minerals Separation experts on Sunday, April 29th 1917, from 1:00 to 5.00 P. M.

Yours very truly,

EDW. WALSER,
Chief Chemist.

E. W./E. G. B.

CC. to: D. C. Jackling.
N. B. MacKelvie.
J. L. Bruce.
C. Bocking.
W. A. Scott.
J. B. Kremer.
J. T. Shimmin.
B. H. Dosenbach.
Edw. Walser.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5302 Defendant's Exhibit No. 228.

Butte & Superior Mining Company.

Data Compiled from Original Records of Flotation Plant Operations, Month of November, 1916.

Flotation Plant Feed.

Date, November.	Lbs. H_2SO_4, 66 Deg. B. per ton.	Lbs. cu. per ton.
1	6.49	.12
2	5.84	.11
3	5.73	.11
4	5.84	.11
5	6.04	.11
6	5.94	.11
7	7.10	.13
8	7.28	.13
9	6.14	.11
10	5.88	.11
11	6.83	.12
12	8.66	.15
13	7.62	.13
14	6.55	.11
15	6.94	.12
16	6.42	.11
17	6.24	.11
18	6.41	.11
19	10.84	.20
20	6.02	.11
21	4.45	.11
22	4.84	.13
23	4.32	.11
24	4.27	.11
25	4.19	.11
26	5.04	.13
27	3.90	.10
28	4.07	.11
29	5.86	.12
30	4.86	.11

J. T. SHIMMIN,
Mill Superintendent.

Compiled May 2, 1917.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5303 Defendant's Exhibit No. 229.

In the Supreme Court of the United States, October Term, 1916.

No. 46.

MINERALS SEPARATION, LIMITED, and MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, Petitioners and Complainants,

against

JAMES M. HYDE, Respondent and Defendant.

Oral Arguments and Illustrations.

Washington, D. C.,

Tuesday, October 1, 1916.

Argument of Mr. William Houston Kenyon in Reply for Petitioners-complainants.

Mr. Kenyon: May it please the Court, the question at issue, and the only question is the question of invention. Did the step that our patentees took constitute invention? The court below said no; it was simply a matter of degree. Respondent's counsel here defends that proposition by saying that our result is attained not by the diminution in the amount of oil, but by some trick of agita-
5304 tion, some novelty of agitation. I will address myself first to that latter proposition.

And the history of the birth of this invention is a complete answer to it. (Record pp. 446-448-451.)

If your Honors have not already marked those pages in the record, I will ask you to mark them; the whole of page 448, the whole of page 451, and, on page 445, the paragraph just below the middle, commencing "peripheral velocity of cone."

Contemporaneous documentary records, written within a few weeks of the birth of this invention—evidence of an extraordinary character of the birth of a most extraordinary invention. These inventors were working on the Cattermole process—which, as has been explained, agglutinates by oil in about three per cent. proportion the metal particles into bigger granules such that they sink against an upcurrent of water which carries the gangue up and away—the Cattermole process. They were experimenting with modifications of all the conditions of that process. Among them one line of investigation was as to the influence of changes of peripheral velocity. All sorts of variations, from 840 to 1,460, in the speed of the cone, were made, but the invention in issue was not born.

Another line of investigation was as to the influence of changes in the amount of oil (page 447, the seventh item). Out of that

series of experiments (where the only change made from experiment to experiment was in the amount of oil—a gradual diminution in the amount of oil, all other things remaining the same) was born this invention.

5305 And the record of it is right there on page 448 "Details of Experiments," the last column, "Remarks" "Float vastly increased"—tracing that back you see it was with three-tenths of one per cent. of oil; and just below "Float" again "vastly increased"—tracing that back it was with one-tenth of one per cent. of oil.

This float phenomenon appeared (page 451) when the oil had been reduced to about one-half of one per cent., said the inventors, after studying the process six weeks.

As the amount of oil was reduced granulation practically ceased at a range of about one-half of one per cent. of oil but a certain amount of black mineral froth was noticed. They were trying to send the values down, but they began to come up to the top.

Mr. Justice Day: Is that on page 451?

Mr. Kenyon: Page 451, the third paragraph.

"A certain amount of black mineral froth was, however, noticed as a result. On successively decreasing the amount of oleic acid below .5 per cent. (that is one-half of one per cent.) it was found that whereas granulation ceased there was a growth in the amount of mineral float-froth under those conditions, and that the production of such float froth appeared to reach a maximum when about .1% of oleic acid on mineral was used."

If that evidence is true it disposes of the contention that this phenomenon which has revolutionized ore concentration the

5306 world over is to be explained as some trick of agitation.

Mr. Justice Day: How do we know that fact, that it has revolutionized ore concentration the world over?

Mr. Kenyon: How do we know it? This record shows that up to 1912 about $9,000,000 worth of values had been taken out in Australia and Sweden and Chile, from dump heaps that had been valueless theretofore, by this process. The testimony that was taken in 1915 before Judge Bradford shows what had happened in the intervening three years, as pointed out in his opinion, during which three years an astounding development occurred in this country.

Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.

Mr. Kenyon: At about one-half of one per cent. of oil.

Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct——

Mr. Justice McReynolds: I want to know when your invention came into existence.

Mr. Kenyon: This invention was not reached, I should say, from those figures, until about .5, that is, one-half of one per cent., of oil was reached.

Defendant's Exhibit No. 230.

CHINO COPPER COMPANY
HURLEY PLANT
Flotation Data for the Period of November 1st to November 30th, Inclusive, 1916.
RETREATMENT OF CONCENTRATES

DATE NOV.	Run	OILS USED Kind	Lbs. per Ton	% Solids	TAILINGS Weight Tons	Tot. % Cu.	% Cu. Oxide	% Fe.	% Insol.	CONCENTRATES Weight Tons	Tot. % Cu.	% Cu. Oxide	% Fe.	Weight Tons	Tot. % Cu.	% Fe.	% Insol.	Ratio of Conct.	% Ind. Recov.	Lbs. Used of Re-agents
1	24	B-J	8.06	46.43	420	3.60	.42	17.8	65.9	314.24	.33	.13	13.4	105.76	13.37	26.6	33.1	3.99	93.13	1000
2	24	B-J-T	7.96	41.58	360	4.03	.39	13.1	74.8	287.57	.27	.13	10.4	72.43	18.97	23.3	34.0	4.97	94.65	1101
3	24	B-J-Ch	12.09	39.31	330	5.87	.29	13.5	64.6	233.23	.24	.08	10.9	96.77	19.43	21.4	30.3	3.41	97.11	1604
4	24	B-J	10.09	40.46	284	6.83	.19	11.1	70.1	201.68	.17	.07	7.5	82.32	23.13	23.1	24.7	3.45	98.23	915
5	24	B-J	6.97	40.42	318	5.00	.50	11.5	71.2	235.83	.23	.13	6.9	82.17	18.70	23.8	26.9	3.87	96.59	2464
6	24	B-J	9.23	37.40	310	4.60	.24	15.3	64.8	227.55	.33	.05	9.1	82.45	16.40	25.1	26.3	3.76	94.73	1697
7	24	B-J	10.04	36.71	282	5.43	.20	12.8	69.1	206.40	.21	0	10.4	75.60	19.70	25.9	24.4	3.73	97.17	1771
8	24	B-J	11.53	34.58	235	7.53	.18	9.2	75.4	168.80	.13	.01	5.6	66.20	26.43	21.0	26.5	3.55	98.76	978
9	24	B-J	10.06	37.31	248	6.03	.21	12.3	69.5	189.92	.38	.02	13.5	58.08	24.53	22.2	22.7	4.27	95.17	924
10	24	B-J	8.97	36.12	291	7.40	.36	12.1	70.4	208.56	.16	0	20.4	82.44	25.70	20.4	29.9	3.53	98.45	1573
11	24	B-J	6.15	37.86	334	8.30	.38	12.0	69.9	239.10	.18	.04	11.6	94.90	28.87	19.0	30.9	3.53	98.45	1643
12	24	B-J	10.67	39.41	312	8.77	.44	9.1	72.3	222.34	.32	.10	10.9	89.66	29.73	16.8	28.5	3.48	97.40	1672
13	24	B-J	9.05	40.23	375	8.37	.27	7.1	75.4	286.76	.31	.04	6.2	88.24	34.60	13.9	27.4	4.25	97.17	922
14	24	B-J	10.80	41.36	345	8.40	.17	10.2	69.6	252.01	.29	.08	8.6	92.99	30.40	15.8	29.3	3.71	97.48	1565
15	24	B-J	12.22	38.25	270	8.23	.14	10.0	69.7	185.09	.37	0	7.9	84.91	25.40	19.2	28.2	3.18	96.92	1646
16	24	B-J	14.23	41.56	292	9.93	.20	16.0	59.0	176.59	.22	.08	15.5	115.41	24.83	17.4	33.5	2.53	98.66	1676
17	24	B-J	15.46	41.83	280	10.23	.17	12.7	65.2	190.54	.20	.05	12.5	89.46	31.63	17.2	26.1	3.13	98.67	883
18	24	B-J	23.98	30.53	176	9.20	.24	10.7	68.1	126.00	.26	.07	8.9	50.00	31.70	16.8	25.9	3.52	97.98	926
19	24	B-J	20.61	32.10	206	12.03	.27	10.5	66.0	135.21	.29	.07	8.9	70.79	34.50	14.8	26.2	2.91	98.42	1707
20	24	B-J	26.98	26.92	179	9.20	.20	9.6	70.7	109.89	.17	.05	5.4	69.11	23.60	17.0	33.7	2.59	98.86	923
21	24	B-J	17.68	36.64	244	9.63	.28	10.8	65.2	152.96	.25	.07	7.8	91.04	25.40	18.8	28.1	2.68	98.37	1586
22	24	B-J	11.31	43.81	358	8.13	.39	20.0	54.5	241.39	.46	.13	14.3	116.61	24.00	24.9	20.8	3.07	96.19	922
23	24	B-J	11.81	40.64	326	5.50	.41	19.2	60.3	234.17	.37	.10	16.0	91.83	18.60	29.0	21.5	3.55	95.17	1619
24	24	B-J	15.09	34.40	285	6.67	.17	15.1	64.4	191.25	.80	.11	12.4	93.75	18.63	27.4	23.5	3.04	91.95	839
25	24	B-J	26.14	28.32	184	7.83	.45	9.2	72.5	114.04	.36	.09	3.9	69.96	19.97	21.1	37.3	2.63	97.15	1576
26	24	B-J	17.37	32.07	247	7.43	.25	14.1	65.7	155.18	.45	.15	7.5	91.82	19.23	24.2	30.2	2.69	96.19	817
27	24	B-J	17.85	33.59	221	8.40	.19	19.5	56.9	115.26	.75	.08	11.6	105.74	16.77	33.5	22.5	2.09	95.34	1620
28	24	B-J	18.41	29.48	208	10.23	.11	11.4	66.1	109.89	.29	.06	4.8	98.11	21.40	21.7	34.4	2.12	98.50	909
29	24	B-J	15.51	36.52	254	10.30	.10	9.8	67.5	152.40	.32	0	4.7	101.60	25.23	17.1	37.9	2.50	98.14	853
30	24	B-J	15.04	35.25	270	10.23	.25	11.1	65.3	168.20	.41	.07	5.5	101.80	26.43	20.6	26.6	2.65	97.50	1625
Averages and totals			13.71	37.03	8444	7.78	.27	12.6	67.3	5832.05	.32	.07	9.8	2611.95	23.91	21.3	28.4	3.16	97.19	40015

NOTE—KINDS OF OIL USED—"B" signifies Barrett's No. 4 Creosote; "J" Jones; "T" Turpentine; "CH" Chesapeake Pine.

NOTE—Reagents includes Na_2S, Rosin and Caustic-Soda.
Dec. 10, 1916.
JDW

C:—F.G.J., W.H.J., J.M.S., F R.W., FILE.

Copied at Butte, Mont., May 2. 1917.

Cost of oil per ton of material treated	.3125
Cost of reagents per ton of material treated	.2086
Approximate cost of oil for month	$2,638.98
Approximate cost of Reagents for month	1,762.21
Lbs. reagents used per ton of material treated	4.74

(Signed) O. WISER,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Mr. Justice McReynolds: At one per cent. you had no invention?

Mr. Kenyon: No.

5307 Mr. Justice McReynolds: At one-half of one per cent. you did have invention?

Mr. Kenyon: It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.

Mr. Justice McReynolds: When this float has more than one-half of one per cent. of oil it does not infringe?

Mr. Kenyon: It does not infringe.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follows Defendant's Exhibit No. 230, marked pages 5308-5309.)

5310-11 Defendant's Exhibit No. 231.

Chino Copper Company,

Hurley Plant.

Rosin and Reagents Used in Vanner Concentrate Flotation Plant During November, 1916.

Date.	Rosin, pounds.	Sodium sulphide, pounds.	Caustic soda, pounds.	Total.
1	270	700	30	1000
2	84	1000	16	1100
3	160	1474	30	1664
4	150	735	30	915
5	233	2184	47	2464
6	200	1457	40	1697
7	270	1451	50	1771
8	200	738	40	978
9	170	724	30	924
10	100	1453	20	1573
11	170	1443	30	1643
12	170	1472	30	1672
13	170	722	30	922
14	100	1445	20	1565
15	170	1446	30	1646
16	200	1446	30	1676
17	134	723	26	883
18	170	726	30	926
19	200	1467	40	1707
20	170	723	30	923
21	135	1426	25	1586
22	170	722	30	922
23	170	1419	30	1619
24	100	719	20	839
25	100	1456	20	1516
26	68	737	12	817
27	135	1460	25	1620
28	150	729	30	909
29	100	733	20	853
30	135	1465	25	1625

Copied from Original Record May 2, 1917.

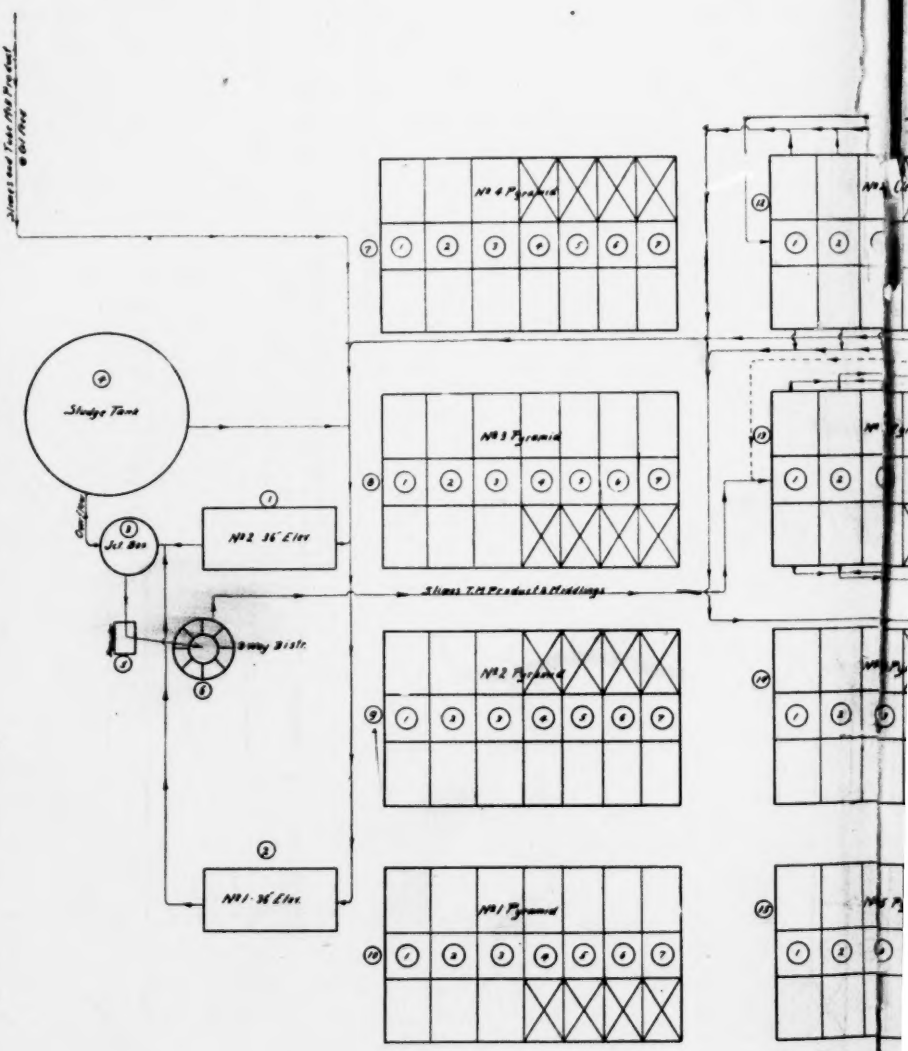
F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Ex

Flow Sheet Butte & Su

5282

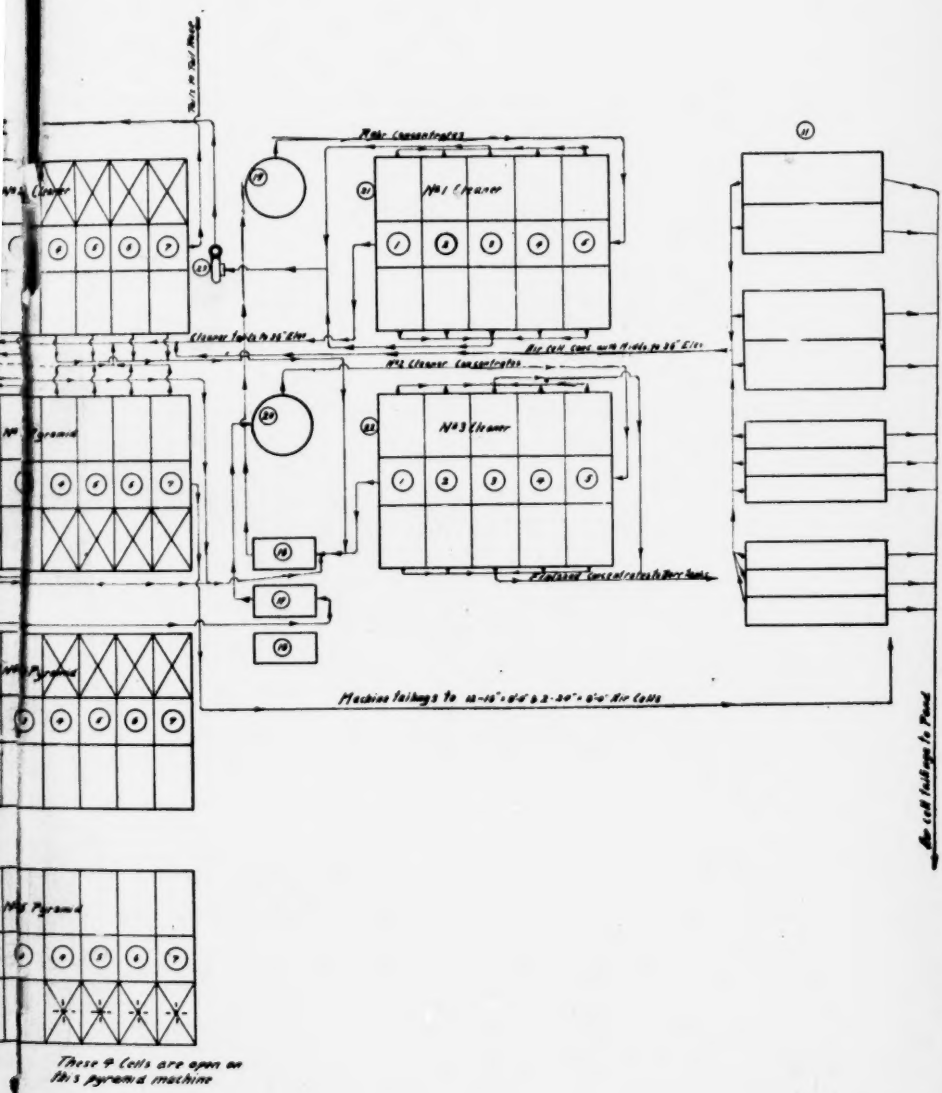


Filed May 18, 1917. Geo

Exhibit No. 222.

Superior Flotation Plant.

5283



W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follows Defendant's Exhibit No. 223 marked pages 5284 and 5285.)

Defendant's Exhibit No. 223.

BUTTE & SUPERIOR MINING COMPANY

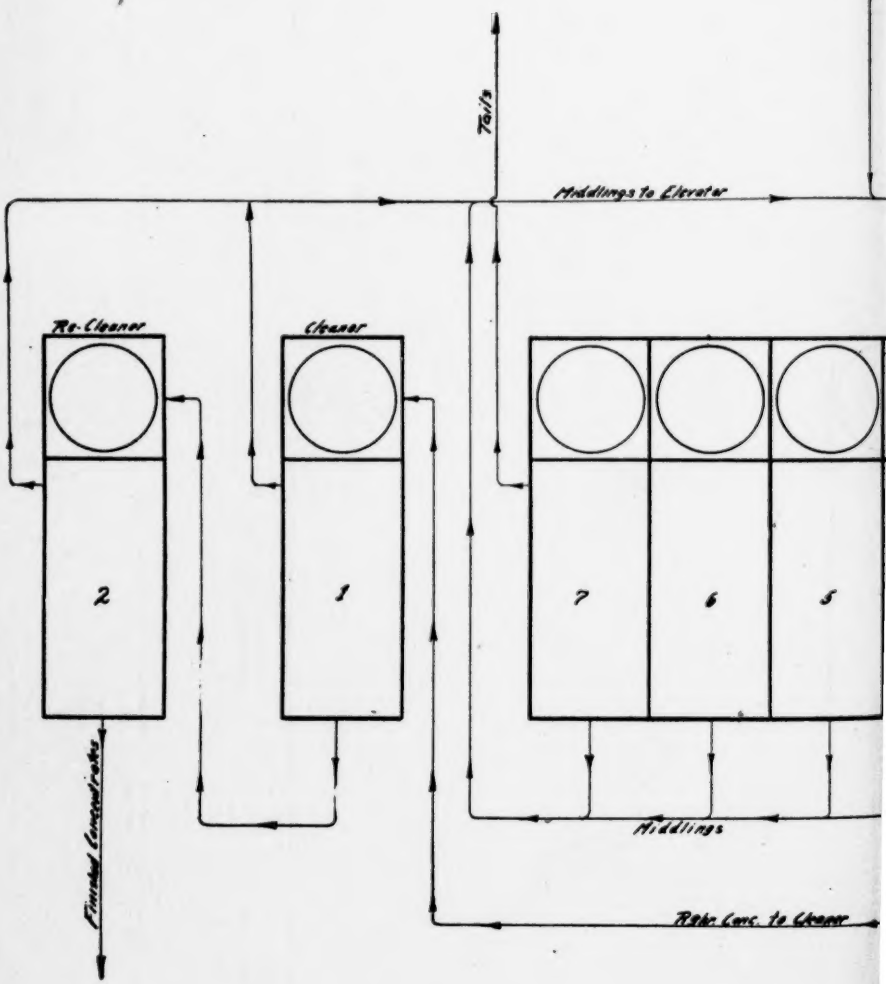
FLOTATION PLANT OPERATIONS FOR THE MONTH OF FEBRUARY, 1917.

DATE	REAGENTS USED Lbs. per Ton of Flotation Feed			Lbs. per Ton Oil in Concts. & Tails	PER CENT OIL			PER CENT ZINC			Dilution of Feed	Temperature of Feed Deg. C.	REMARKS
	H_2SO_4	$CuSO_4$	Metallic Copper	Initial Oil		Heads & Middling Return	Concts.	Tailings	Heads	Concts.	Tailings			
Feb. 1	8.07	5.17	.062	10.77	11.00	.64	1.45	.30	12.11	50.20	1.41	2.2 to 1	29	Good run
Feb. 2	7.17	5.99	.072	13.94	11.40	.70	1.34	.31	13.47	49.00	1.13	3.3 to 1	29	Good run
Feb. 3	9.20	6.96	.098	17.78	13.80	.73	1.36	.47	14.15	48.00	2.42	3.3 to 1	26	High tailings due to poor operation on No. 1 Rougher
Feb. 4	8.37	5.23	.063	19.83	11.00	.74	1.12	.42	11.75	50.70	2.12	2.4 to 1	20	Machines handling too coarse feed
Feb. 5	8.61	5.92	.071	20.99	12.20	.79	1.12	.46	13.30	50.20	2.04	2.7 to 1	34	Feed still too coarse for good results
Feb. 6	12.69	5.64	.068	24.31	15.20	.78	1.04	.69	12.80	51.20	2.12	2.6 to 1	24	Several changes in reagents caused a rather erratic and unsettled condition throughout the plant
Feb. 7	7.83	5.65	.068	19.03	13.40	.76	1.34	.50	12.56	50.90	2.06	2.9 to 1	19	Elevators going in pit off and on all day
Feb. 8	10.73	5.40	.065	16.86	13.00	.79	1.10	.55	12.71	51.30	3.40	2.6 to 1	19	Elevators still giving considerable trouble
Feb. 9	9.45	5.81	.070	19.65	13.00	.75	1.53	.43	13.38	52.30	2.76	2.6 to 1	21	Considerable trouble with frozen oil lines, causing many changes in reagents, hence poor operative results
Feb. 10	11.36	8.20	.098	20.75	18.20	1.08	2.10	.54	14.27	51.40	2.24	2.4 to 1	27	Conditions on this day same as that of previous day
Feb. 11	7.69	5.11	.061	15.34	12.00	.85	1.59	.30	11.83	47.20	1.81	2.9 to 1	24	Mill down first two shifts account lack of ore
Feb. 12	10.81	6.70	.080	16.24	18.40	1.14	2.31	.52	13.19	49.20	2.60	2.7 to 1	25	Elevators in Pit most of day. All feeds cut off for 2½ hours on this account
Feb. 13	11.60	6.63	.079	19.62	20.80	1.36	2.66	.73	11.76	50.70	3.80	2.1 to 1	24	Conditions in plant unsettled due to overfeeding machines and more or less elevator trouble
Feb. 14	18.40	7.02	0.84	13.93	17.20	1.12	2.49	.49	11.40	51.70	1.96	2.4 to 1	28	Good run
Feb. 15	7.31	6.27	.075	16.57	16.00	.99	2.24	.42	12.77	47.70	2.90	1.8 to 1	28	Rougher Concts. direct to bins, account mechanical difficulties on cleaners and recleaners
Feb. 16	11.57	8.53	.124	24.86	16.40	1.27	1.94	.56	10.56	46.80	1.49	1.9 to 1	21	Fair run
Feb. 17	10.43	8.92	.130	22.05	19.60	1.24	1.95	.71	12.78	49.40	1.67	2.8 to 1	18	Fair run
Feb. 18	10.49	8.00	.116	21.80	18.80	1.74	1.94	.60	13.90	44.40	1.10	1.4 to 1	21	Fair run
Feb. 19	10.65	11.00	.153	21.40	19.40	2.02	2.02	.66	12.46	44.80	.92	2.2 to 1	21	Fair run
Feb. 20	9.62	10.45	.153	21.56	18.80	2.51	1.93	.56	12.95	46.50	.90	2.6 to 1	23	Fair run
Feb. 21	7.84	5.37	.074	17.69	18.80	1.24	1.87	.59	13.99	47.00	.99	2.0 to 1	24	Very good run considering the fact that the machines were handling an extra large tonnage
Feb. 22	10.92	7.64	.100	20.22	18.80	2.85	2.29	.54	13.69	51.30	2.19	2.2 to 1	21	Elevators giving considerable trouble Middling return cut down to lighten load to elevators
Feb. 23	11.71	4.31	.064	14.97	21.20	1.35	2.47	.59	15.35	51.70	2.24	2.3 to 1	18	Changed reagents several times during day which caused confusion in entire plant
Feb. 24	11.76	7.59	.097	24.13	17.40	1.05	2.08	.46	14.31	48.60	2.10	2.4 to 1	20	Same trouble as day previous
Feb. 25	9.77	7.59	.097	22.41	15.80	1.13	1.66	.54	13.40	43.60	1.01	2.8 to 1	16	Cleaner and recleaner cells out of order
Feb. 26	9.60	5.73	.079	24.17	16.20	1.17	1.69	.45	14.04	43.20	1.19	2.5 to 1	16	Cleaner and recleaner still out of order and elevators giving considerable trouble
Feb. 27	10.47	8.00	.109	20.85	19.40	1.14	1.61	.62	15.78	41.30	1.69	2.7 to 1	16	Trouble at concentrate bins caused considerable trouble in plant account shutting down and starting again
Feb. 28	7.74	6.84	.094	19.30	20.60	1.26	1.90	.68	14.66	43.90	2.50	2.2 to 1	14	Overfeeding machines and elevators. Unable to handle return feed

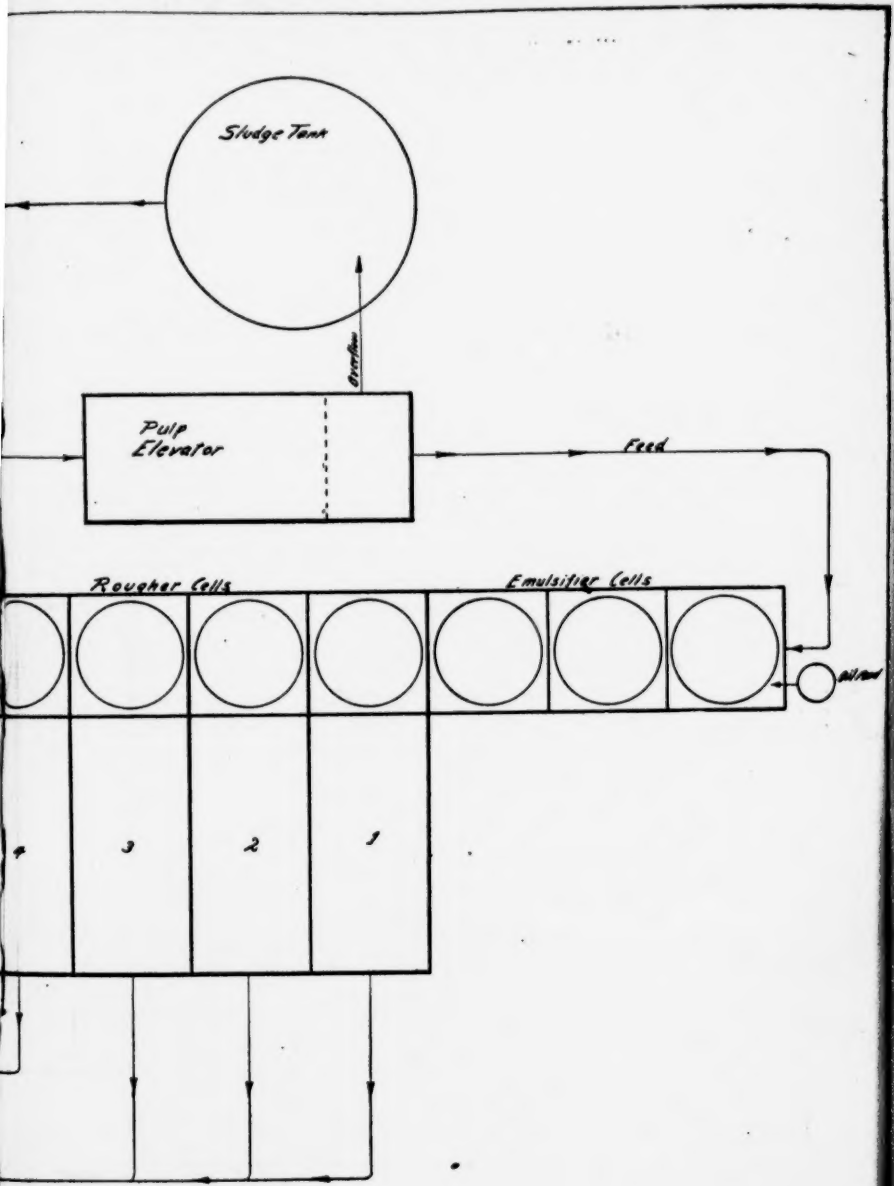
Butte, Montana,
April 21, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

286 Defendant's Exhibit No. 224.

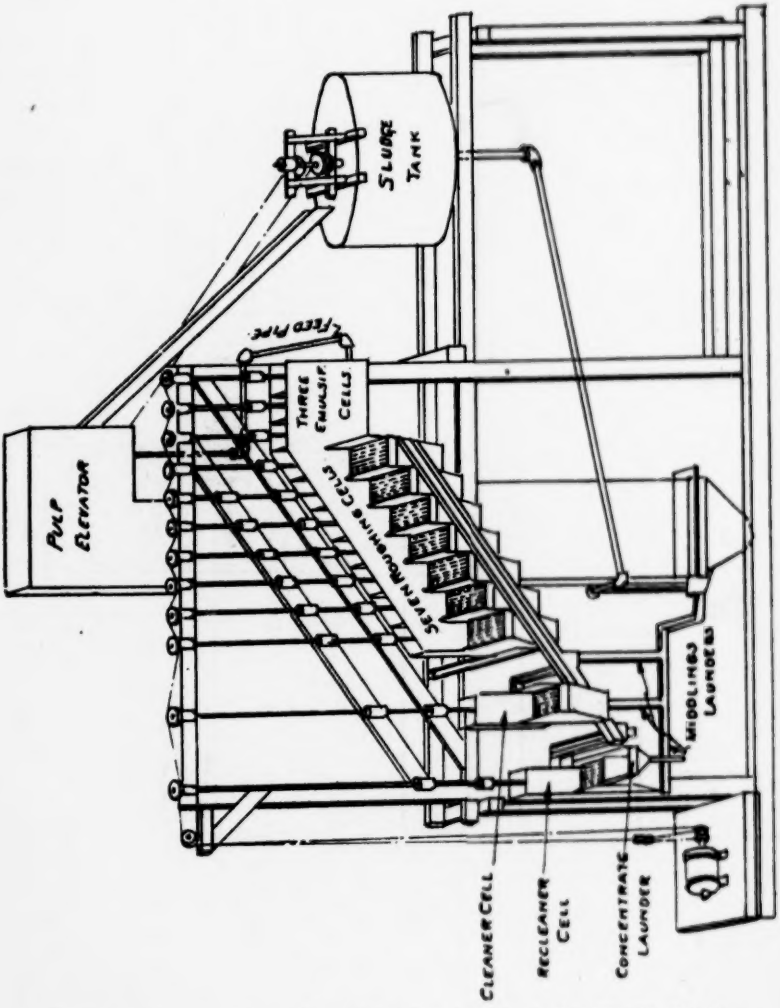


Flow Sheet of Butte & Superior Seven Cell Test Machine. 5287–88



5289

Defendant's Exhibit No. 225.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Defendant's Exhibit No. 226.

Butte & Superior Seven-cell Test Machine—Physical Exhibit.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5312 Defendant's Exhibit No. 232.

2–396.

Department of the Interior,

United States Patent Office.

To all persons to whom these presents shall come, Greeting:

This is to certify, that the annexed is a true copy of the only instrument of writing found of record from June 19, 1909, up to and including April 7, 1917, which may affect the title of the Letters Patent of James M. Hyde, Number 1,022,085, granted April 2, 1912, for Improvement in Art of Concentration of Mineral Substances.

Recorded in Liber and page as designated on the margin of said instrument.

Said record has been carefully compared with the original and is a correct transcript of the whole thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 24th day of April, in the year of our Lord one thousand
5313 nine hundred and seventeen, and of the Independence of the United States of America the one hundred and forty-first.

[Seal Patent Office, United States of America.]

F. W. H. CLAY,
Acting Commissioner of Patents.

Liber X 91, Page 300.

Whereas, I, James M. Hyde, formerly of Basin, Montana, and now of Berkeley, California, did obtain letters patent of the United States for improvement in Art of Concentration of Mineral Substances, which letters patent are numbered 1,022,085, and bear date the 2nd day of April, 1912; and whereas, I am now the sole owner of the said patent and of all rights under the same in the below-recited territory; and whereas Butte and Superior Copper Company, Limited, an Arizona corporation, is desirous of acquiring an interest in the same;

Now therefore, to all whom it may concern, be it known that, for and in consideration of the sum of One ($1.00) Dollar, and other valuable consideration, to me in hand paid, the receipt of which is hereby acknowledged, I, the said James M. Hyde, have sold, assigned, and transferred, and by these patents, do sell, assign and transfer unto the said Butte and Superior Copper Company, Limited,
5314 all the right, title and interest in and to the said invention, as secured to me by said letters patent, for, to and in the County of Silverbow, State of Montana, and for, to, or in said place

or places; the same to be held and enjoyed by the said Butte and Superior Copper Company, Limited, within and throughout the above specified territory, but not elsewhere, for its own use and behoof, and for the use and behoof of its legal representatives or its assigns, to the full end of the term for which said letters patent are or may be granted, as fully and entirely as the same would have been held and enjoyed by me had this assignment and sale not been made. It being the intent hereof that the rights acquired by the Butte and Superior Copper Company, Limited, hereunder may at any time be assigned by the said Butte and Superior Copper Company, Limited, to others.

It is the intent of the said James M. Hyde to assign and transfer to the Butte and Superior Copper Company, Limited, an Arizona corporation, conducting a mining and milling business in Butte, Montana, the exclusive right of treating by my process all ores mined in Silverbow County, Montana, or shipped into Silverbow County, Montana, or whether milled in said Silverbow County, Montana, or outside thereof.

In testimony whereof, I have hereunto set my hand and affixed my seal at Butte, in the County of Silverbow, and State of Montana, this 19 day of April, 1913.

JAMES M. HYDE.

5315 STATE OF MONTANA,
County of Silverbow, ss:

On this 19 day of April, 1913, before me, the undersigned, a Notary Public, in and for the State of Montana, residing at Butte, Montana, personally appeared James M. Hyde, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same.

In witness whereof, I have hereunto set my hand and affixed my notarial seal the day and year in this certificate first above written.

[Notarial Seal Louis P. Sanders, State of Montana.]

LOUIS P. SANDERS,
Notary Public in and for the State of Montana,
Residing at Butte, Montana.

My commission expires July 17, 1915.

Recorded May 7, 1913.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5316 Plaintiff's Exhibit No. 233.

Admitted.

Basin, Montana, September 5, 1911.

Mr. W. A. Clark, Jr., Los Angeles, Cal.

DEAR SIR: The fifty ton test plant has now run satisfactorily for such a length of time that I am warranted in assuring you that my adaptation of the gas bubble flotation process is a pronounced success in treating the ore of the Black Rock Mine.

2–390.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

By permission of Mr. Atwater, I enclose herewith a copy of a recent report presented to him; and also refer you to him for a verification of my statements and for any further information you may desire concerning the results of the work we have been doing at Basin.

Since the completion of the machine by the addition of the cleaner, which was part of the original plan, all of the concentrates produced have been of good marketable grade. On two or three occasions the feed has been too coarse for the process, and the concentrate has been of lower grade because of attached particles of silica. Mr. Pratt's samples were taken on one of these occasions. Our shipments of flotation concentrates have steadily increased in grade. Four carloads have averaged as follows:—48.6, 49.6, 51.0, 51.7.

5317 The mill has run a slime department similar to yours with practically the same results which you have obtained. All of the material formerly treated in the slime department is now being treated by the flotation process. We have also treated the accumulated slimes concentrate, raising the grade of the same from about 41% to over 53%.

Mr. Siderfin and Mr. Pratt have visited the plant independently and we gave them samples taken in their presence. On both occasions the machine was just being started up. The first tailings sample was taken in each case before the machine was doing its best work.

I enclose herewith a copy of a letter sent to Mr. Siderfin at his request, and make the following quotation from a letter received from him—"The returns for the samples which I brought back with me are shown on the following page:—

	% zinc.
Heads	20.4
Tails	4.0
Tails No. 2	2.3
Concentrates	52.9

"Mr. Pratt seems to have been quite pleased with the results you were getting on the machine, and has had the samples that he brought back tested with the following results:

5318	% zinc.	Ozs. silver.
Feed	17.0	8.8
Tails	3.6	2.4
Tails No. 2	1.6	1.6
Concentrates	44.7	19.5"

The Butte and Superior Co. is so pleased with the results accomplished that they are now remodelling their plant to provide for fine grinding of the jig tailings and treating them and all of the slimes by the flotation process. The new machine should be running in less than a month from now. They are also getting out plans for a 500 ton mill to be erected at once. I am assisting in getting out these plans.

The patent phase of the situation has been gone into very thoroughly by their local attorneys who have submitted the matter to one of the best firms of patent attorneys in the country, whose report has not yet been received. As the company is going ahead with the use of the process here and are designing the new mill to use it, it is apparent that their investigation has led them to be certain that the threats of litigation have been mere bluffs made in an attempt to make them pay an exorbitant price.

I saw Mr. Pyle in Butte a few days ago and told him that I thought I should wait until the larger machine was working before communicating with you.

I am anxious to get my family away from here before the cold weather sets in. It now appears that things are likely to shape themselves so that we can leave for California in six or seven weeks.

5319 Therefore I have considered it best to inform you of the complete success of the operations here, and to inform you that it is possible to complete an installation for you within four or five weeks if you care to proceed with the matter at once.

My agreement with the Butte and Superior Co. provides for me to be paid in proportion to the extra profit which they make as a result of the use of the flotation process. They expect my compensation to amount *of* $30,000, on the basis of $1,000 for each $600 extra profit made in a 30 day run.

As your tonnage treated is about one half of theirs and they have borne all of the expense of proving the process a phenomenal success in treating this ore, I prefer to deal with you on the following basis.

If you appoint me as consulting engineer for this work, I will plan and supervise the construction and starting of a flotation machine

capable of treating the amount of ore you are now milling. I will leave a man with you who is competent to handle the machine satisfactorily. If you wish me to do so I will act as consultant for you in relation to the work carried on in your Butte mill for one year, without further compensation than the fee herein stated

I will expect my fee to be $15,000, to be paid as follows—$5,000 when the agreement is drawn up and $10,000 when the machine is completed.

These terms would apply only if the work is to be undertaken at once.

The machinery and construction work necessary should not
5320 cost more than $4,000 or $5,000 unless you instal tube mills at an additional cost of $5,000 to $6,000. It is very possible that your Chili mills will grind fine enough so that tube mills will not be needed.

Mr. Atwater will assure you that my estimates of costs and recoveries have been conservative.

Hoping to have an early reply, I remain

Respectfully yours

(Signed) JAMES M. HYDE.

P. S.—I will consider it a favor if you do not mention the terms of my contract with the Butte & Superior Co. to anyone.

J. M. H.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5321 Defendant's Exhibit No. 234.

This is to certify that the records of this office show that no disclaimer was filed in the United States Patent Office of any claims in Letters Patent of the United States Number 835,120 granted November 6, 1906, to Henry Livingston Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot until March 28, 1917, and that no other disclaimer has been filed than the disclaimer filed on said date of which the attached is a true copy.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 17th day of April, in the year of our Lord one thousand nine hundred and seventeen and of the Independence of the United States of America the one hundred and forty-first.

T. W. H. CLAY,

Acting Commissioner of Patents.

5322 $10.00 Rec'd Mar. 28, 1917. H. C. C., U. S. Pat. Office.

Disclaimer Recorded March 28, 1917.

United States Patent Office.

Hon. Commissioner of Patents.

SIR: Your petitioner, Minerals Separation, Limited, a corporation organized and existing under the laws of Great Britain and having its principal place of business in London, England, hereby represents as follows:

1. That on November 6th, 1906, Letters Patent of the United States for Ore Concentration, No. 835,120, were granted to Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, of London, England, and your petitioner is now the sole and exclusive owner of the said Letters Patent.

2. That by the decision of the Supreme Court of the United States in Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, vs. James M. Hyde, filed the 11th day of December, 1916, your petitioner is advised that the said Letters Patent No. 835,120, in so far as concerns Claims 9, 10 and 11 thereof, covers and includes more than the said inventors had a right to claim as new.

3. That the matter which the said patentees and your
5323 petitioner are, in accordance with the said decision of the said court, not entitled to hold or claim by virtue of said claims 9, 10 and 11 of said Letters Patent No. 835,120, was included therein by mistake, and without fraudulent or deceptive intent, and without any willful default or intent to defraud or mislead the public.

4. That the subject-matter not herein and hereby disclaimed is definitely distinguishable from the part or parts disclaimed herein, and is truly and justly the invention of the said Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, and is a material and substantial part of the thing patented.

Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore.

In witness whereof your petitioner has caused these presents to be signed and sealed by John Ballot, its duly constituted attorney in fact under and by virtue of a power of attorney dated December 14, 1915, and recorded in the United States Patent Office November 27, 1916,

in Liber K 101, page 176 of Transfers of Patents, this 27th
5324 day of March, 1917.

MINERALS SEPARATION, LIMITED,
By JOHN BALLOT, *Attorney in Fact.*

In presence of:
S. GREGORY.
HENRY D. WILLIAMS.

STATE OF NEW YORK,
County of New York, ss:

On this 27th day of March, 1917, before me personally came John Ballot, attorney in fact of Minerals Separation Limited, a company organized under the laws of Great Britain, to me personally known, and known to me to be the individual described and who, as such attorney, executed the within petition and acknowledged that he executed the same as the act and deed of Minerals Separation, Limited, therein described, by virtue of a power of attorney duly executed by said Minerals Separation, Limited, bearing date December 14, 1915, which power of attorney was exhibited to me, and he stated that it was still in force and effect.

[SEAL.] HARRY C. LEWIS,
Notary Public, Bronx Co., No. 12.

Certificate filed in New York County, No. 41.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5325 Defendant's Exhibit No. 235.

Butte & Superior Mining Company.

Report No. 118.

April 28th.

General Flotation Operation:—

The oils used were:
Standard Yaryan pine, 18.53% of total oil.
Fuel oil, 70.62% of total oil.
Commercial kerosene, 10.85% of total oil.
Period of operation, 24 hours.
Flotation feed tonnage, 24 hrs., 1,262 dry tons.
Flotation concentrates produced, 300 dry tons.
Temperature of feed, atmospheric.
Dilution of feed, 4.93 : : 1.

Oils and Reagents Used.

Pine oil lb./ton.	Fuel oil lb./ton.	Commercial kerosene lb./ton.	Sulphuric acid lb./ton.	Copper sulphate A. C. M. solution lb./ton.
3.69	14.05	2.16	11.11	(a) 5.92

(a) Equivalent to 0.09 pounds metallic copper per ton.

Metallic copper consumed, 113.62 pounds.
Actual initial oil added:—

Commercial kerosene	2,725	pounds
Fuel oil	17,737	"
Standard Yaryan pine	4,655	"
Actual initial oil added	25,117	"
Initial oil added per ton	19.90	"

5326 Butte & Superior Mining Company.

Report No. 118.

April 28th.

The assay results and oil analyses for this date are as follows:

	Flotation feed including circulating load.		Tailing.		Concentrate.	
	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.
7– 3 Shift.....	15.8	1.55	1.81	0.63	41.9	2.21
3–11 "	15.0	1.59	1.39	0.45	42.5	2.89
11– 7 "	12.5	1.88	1.45	0.71	43.8	3.31
Average	(b)14.43	(b)1.67	(a)1.56	(b).60	(a)42.8	(b)2.80

(a) Assay composites.
(b) Numerical averages.

Butte & Superior Mining Company.

Report No. 119.

April 29th.

General Flotation Operation:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00. P M. to 7:00 A. M.
The oils used were:
Commercial Kerosene, 11.23% of total oil.

Fuel Oil, 64.47% of total oil.
Standard Yaryan Pine, 24.30% of total oil.
Period of operation, 20 hours.
Tonnage treated per 20 hours, 1,239.47 dry tons.
Flotation concentrate produced, 282.84 dry tons.
Temperature of feed, atmospheric.
Dilution of feed, 3.97 : : 1.

5327 Oils and Reagents Used.

Commercial kerosene lb./ton.	Fuel oil lb./ton.	Pine oil lb./ton.	Sulphuric acid lb./ton.	Copper sulphate A. C. M. Solution lb./ton.
2.67	15.32	5.77	6.87	(a) 6.27

Metallic copper consumed, 118.09 pounds.
Initial oil added per ton, 23.76 pounds.

Butte & Superior Mining Company.

Report No. 119.

April 29th.

General Flotation Operation:—

2nd Period—1:00 P. M. to 5:00 P. M.
The oils used were:—
Commercial Kerosene, 11.23% of total oil.
Fuel Oil, 64.47% of total oil.
Standard Yaryan Pine, 24.30% of total oil.
Period of operation, 4 hours.
Tonnage treated per four hours, 263.53 dry tons.
Flotation concentrate produced, 60.16 dry tons.
Temperature of feed, atmospheric.
Dilution of feed, 3:45 : : 1.

Oils and Reagents Used.

Commercial kerosene lb./ton.	Fuel oil lb./ton.	Pine oil lb./ton.	Sulphuric acid lb./ton.	Copper sulphate A. C. M. Solution lb./ton.
2.96	17.00	6.41	7.08	(a) 6.50

Metallic copper consumed, 26.02 pounds.
Initial oil added per ton, 26.37 pounds.

H. J. S.—J. D. S.

(a) Equivalent to 0.10 pounds metallic copper per ton.

5328 Butte & Superior Mining Company.

Report No. 119.

April 29th.

Actual initial oil added during 24 hours period:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00 P. M. to 7:00 A. M.

Commercial Kerosene	3,306 pounds.
Fuel Oil	18,988 pounds.
Standard Yaryan Pine	7,155 pounds.
Total	29,449 pounds.

2nd Period—1:00 P. M. to 5:00 P. M.

Commercial Kerosene	780 pounds.
Fuel Oil	4,479 pounds.
Standard Yaryan Pine	1,689 pounds.
Total	6,948 pounds.

Total actual initial oil added	36,397 pounds.
Total actual initial oil added per ton	24.21 pounds.

H. J. S.—J. D. S.

5329 Butte & Superior Mining Company.

Report No. 119.

April 29th.

The assay results and oil analysis for this date are as follows:—

1st Period—7:00 A. M. to 1:00 P. M. and 5:00 P. M. to 7:00 A. M.

	Flotation feed including circulating load.		Tailing.		Concentrate.	
	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.
7:00 A. M.— 1:00 P. M...	12.1	2.34	1.19	1.29	44.3	3.18
5:00 P. M.— 11:00 P. M...	13.7	2.62	1.69	1.18	46.8	4.72
11:00 P. M.— 7:00 A. M...	13.9	1.88	1.57	1.47	45.2	3.31
Average..	(a)13.2	(a)2.28	(b)1.55	(a)1.31	(b)45.6	(a)3.74

(a) Numerical average.
(b) Assay composites.

2nd Period—1:00 P. M. to 5:00 P. M.

	Flotation feed including circulating load.		Tailing.		Concentrate.	
	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.
1:00 P. M. to 5:00 P. M. ...	12.6	1.77	1.57	0.67	45.2	3.13

H. J. S.—J. D. S.

5330 Butte & Superior Mining Company.

Report No. 120.

April 30th.

General Flotation Operation:

The oils used were:—
Standard Yaryan Pine, 9.68% of total oil.
Fuel Oil, 78.58% of total oil.
Commercial Kerosene, 11.74% of total oil.
Period of operation, 24 hours.
Flotation feed tonnage 24 hours, 1,608 dry tons.
Flotation concentrates produced, 383 dry tons.
Temperature of feed, atmospheric.
Dilution of feed, 3.53 : : 1.

Oils and Reagents Used.

Pine oil lb./ton.	Fuel oil lb./ton.	Commercial kerosene lb./ton.	Sulphuric acid lb./ton.	Copper sulphate A. C. M. solution lb./ton.
2.61	21.16	3.16	6.46	(a) 6.80

Metallic copper consumed ..... 166.12 pounds.

Actual Initial Oil added:

Commercial Kerosene	5,085	pounds.
Fuel Oil	34,027	pounds.
Standard Yaryan Pine	4,189	pounds.
Total	43,301	pounds.
Initial oil added per ton	26.93	pounds.

(a) Equivalent to 0.10 pounds of metallic copper per ton.

5331 Butte & Superior Mining Company,

Report No. 120,

April 30th.

The assay results and oil analyses for this date are as follows:

	Flotation feed including circulating load.		Tailing.		Concentrate.	
	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.	Assay % zn.	Analysis % oil.
7– 3 Shift.....	13.3	1.87	1.72	0.69	42.8	3.42
3–11 "	12.5	2.08	1.44	0.73	42.7	4.05
11– 7 "	18.6	1.74	2.52	1.36	43.6	4.26
Average..	(*b*)14.8	(*b*)1.90	(*a*)1.92	(*b*).93	(*a*)43.4	(*b*)3.91

(*a*)—Assay composites.
(*b*)—Numerical averages.

H. J. S.—J. D. S.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H Walker, Deputy.

5332 Plaintiff's Exhibit No. 236.

United States District Court, District of Montana.

MINERALS SEPARATION, LIMITED, Plaintiff.

vs.

BUTTE & SUPERIOR MINING COMPANY, Defendant.

STATE OF NEW YORK,
County of New York, ss:

Harry Falck, being duly sworn, deposes and says:

I am a resident of the City of New York, State of New York, and am the general office manager for Beer, Sondheimer & Co. Inc., the American agents for Minerals Separation Ltd., the plaintiff in this action.

It is a part of my duty as office manager for said Beer, Sondheimer & Co. Inc. to be familiar with the granting of licenses by Minerals Separation Ltd. in this country and the payment of royalties thereunder. It is my duty to receive the statements of returns rendered by the licensees of the patent here in suit to the plaintiff herein, and

to prepare bills based on such statements if correct for royalties due under the licenses and to keep account of the royalties paid to Beer, Sondheimer & Co. Inc. as agents for the plaintiff. I have
5333 prepared a statement giving the name of each licensee, the period during which the process of the patent in suit has been carried on by such licensee, the number of tons of material treated, or the number of tons of concentrates recovered, and the amount of royalties paid to Minerals Separation Ltd. by such licensee which is hereto annexed. These figures are taken from the statement of returns rendered to Minerals Separation Ltd. by the licensees and from the books of Beer, Sondheimer & Co. Inc., and have been carefully checked by me, and are true and correct.

HARRY FALCK.

Subscribed and sworn to before me this 10th day of April, 1917.
[SEAL.] HARRY C. LEWIS,
Notary Public, Bronx Co., No. 11.

Certificate filed in New York County, No. 93.

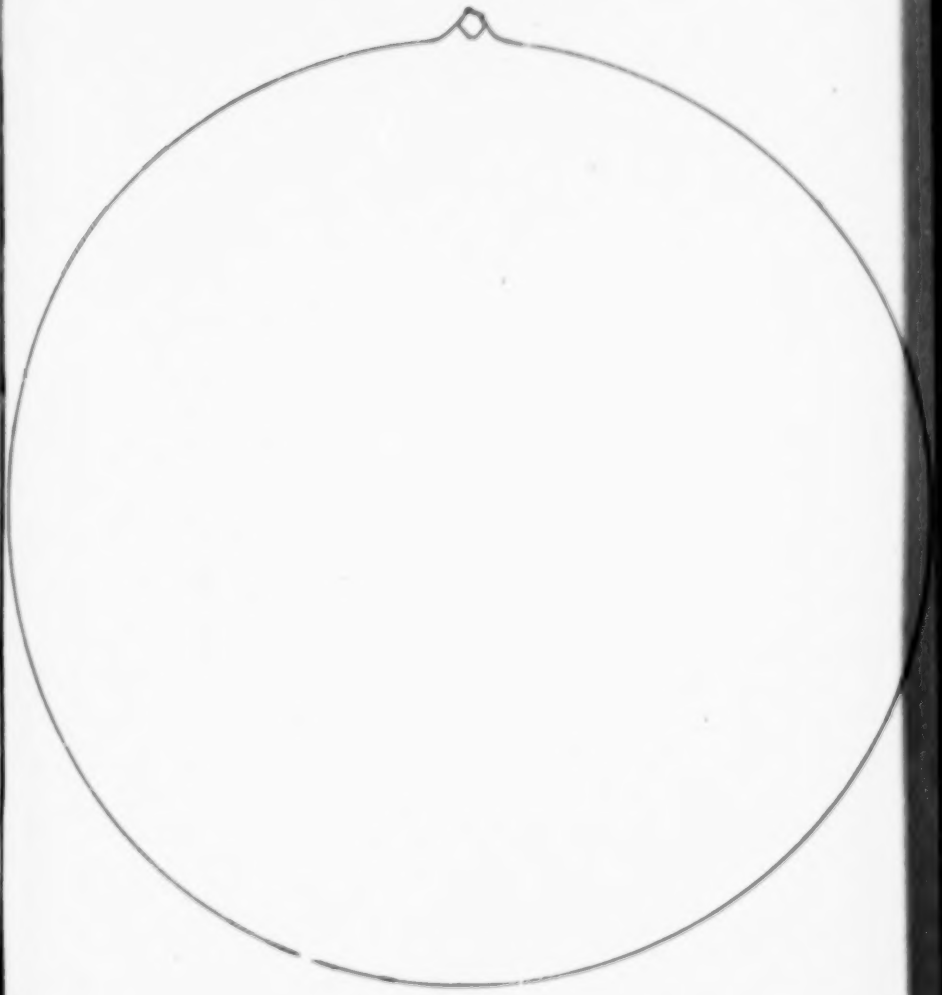
Name.	Period.	Tonnage material treated.	Tonnage concentrates recovered.	Amount.
Inspiration Cons. Copper Co.....	Jan. /14 to June 30/15	257270.4	Not Reported	$30871.36
Consolidated Arizona Smelt. Co....	June /14 to Jan. /17	197952.65	Not Reported	26595.24
Atlas Min. & Milling Co.....	Oct. /13 to Dec. 31/17	102596.50	Not Reported	14730.27
Anaconda Copper Mining Co....				
Cananea Cons. Copper Co.....	Apr. 1/15 to Dec. 31/16	11785189.3455	Not Reported	536826.60
Inspiration Cons. Copper Co.....				
Arizona Copper Company, Ltd...				
Mountain Copper Company, Ltd...	Apr. 1/16 to Dec. 31/16	98573.10	Not Reported	12847.12
Engels Copper Mining Company...	Jan. 1/15 to Dec. 31/16	200135.34	Not Reported	26644.21
Utah Leasing Company	Nov. /15 to Dec. 31/16	175923.00	Not Reported	10555.38
Colusa Parrot Min. & Smelt. Co....	July /16 to Jan. /17	69798.9635	Not Reported	4188.00
Chicagoff Mining Company.....	July 1/16 to Dec. 31/16	13094.00	Not Reported	1309.40
Stoddard Milling Company.....	Aug. 14/16 to Dec. 31/16	14716.00	Not Reported	3769.00
Goldfield Cons. Mines Co.....	Mar. /16 to Nov. /16	37789.00	Not Reported	7557.80
Elm Orlu Mining Company.....	June 26/14 to Dec. 31/16	Not Reported	121630.713	141627.68
St. Joseph Lead Company.....	Apr. 1/14 to Dec. 31/16	Not Reported	42550.747	26271.39
Doe Run Lead Company.....	Apr. /14 to Dec. 31/16	Not Reported	23516.759	18217.08
Desloge Cons. Lead Company.....	Jan. 1/16 to Dec. 31/16	Not Reported	5337.945	4689.89
Maxwell W. Atwater	June 22/14 to Sep. 30/16	Not Reported	10643.155	13303.93
McDonald & Noble.....	Oct. /13 to Dec. 31/16	Not Reported	9418.000	5602.68
Weedon Mining Company.....	July 23/15 to June 1/16	Not Reported	1225.00	833.00
Butte Central Min. & Mill. Co.....	to Mar. 1/17	Not Reported	588.646	990.00
Napoleon Mining Company	Oct. 1/15 to June 30/16	Not Reported	430.929	298.38
Dutch Sweeney Mining Company..	Dec. /16 to Feb. /17	Not Reported	2126.45 Oz. Au.	531.61
Portland Gold Mining Company...	Nov. /16 to Sep. 30/16	Not Reported	9602.5779 Oz. Au.	2400.64
				$$1155258.24

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5335

Plaintiff's Exhibit No. 237.

Diagram No. 1.

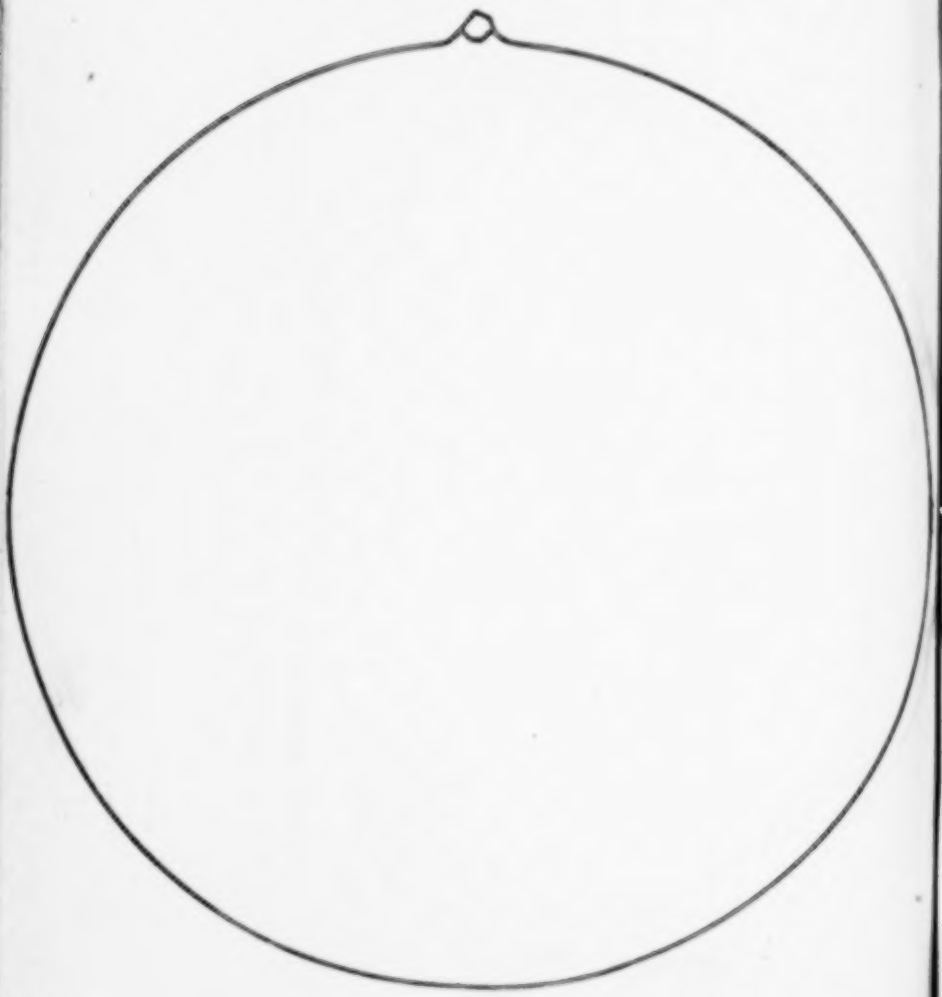


Filed August 15, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5336

Plaintiff's Exhibit No. 238.

Diagram No. 2.

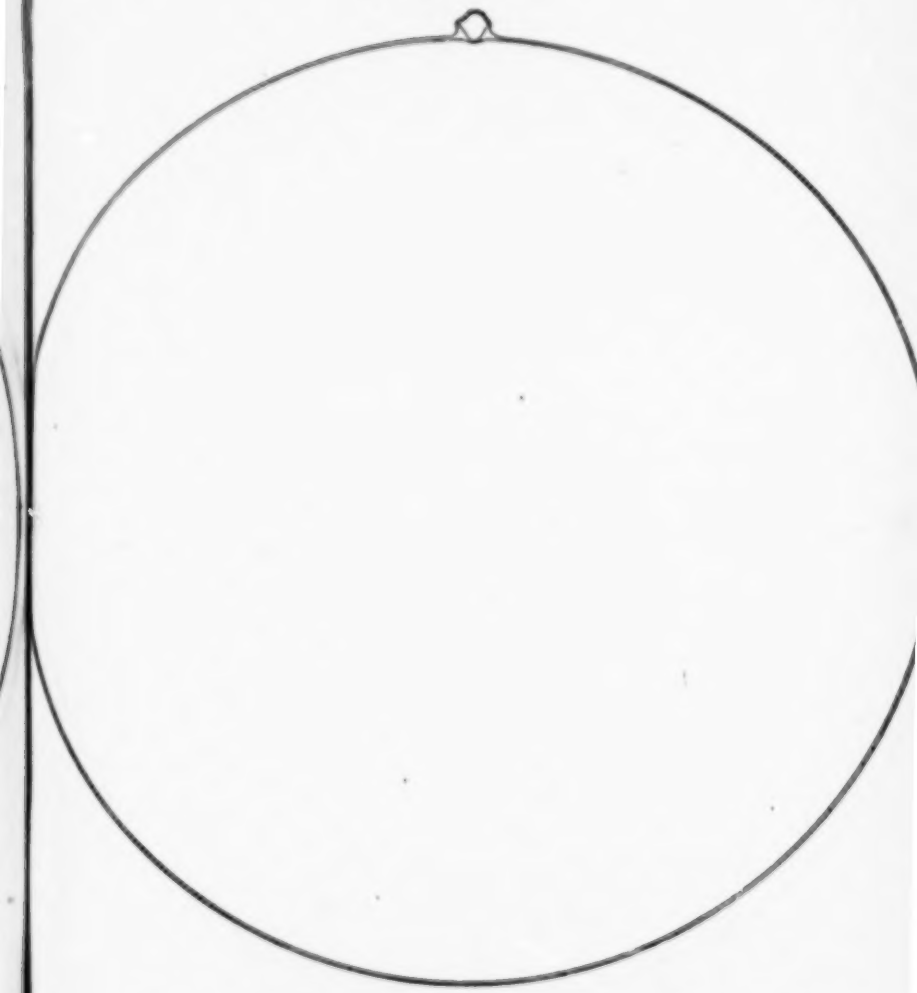


Filed August 15, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5337

Plaintiff's Exhibit 239.

Diagram No. 3.

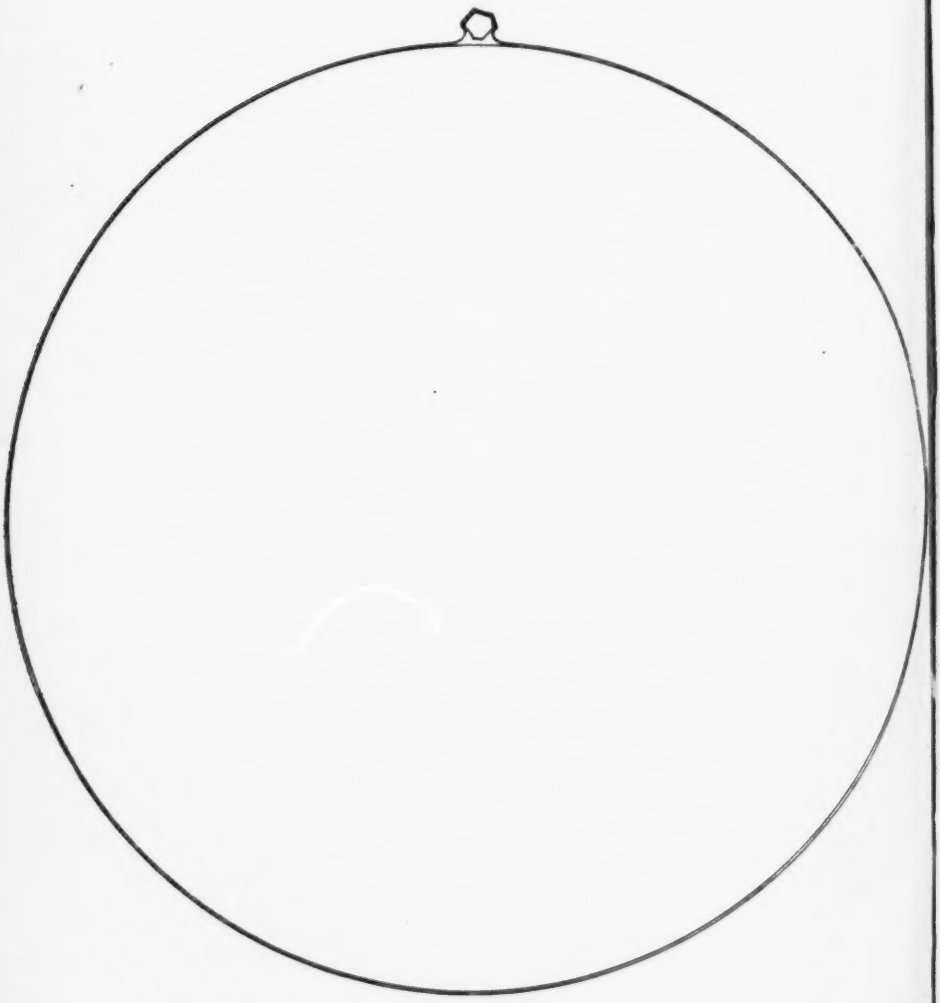


Filed August 15, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5338

Plaintiff's Exhibit No. 240.

Diagram No. 4.



Filed August 15, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5339—40—41

DIAGRAM No. 5— PLAINTIFF'S EXHIBIT No. 241

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5342

Plaintiff's Exhibit

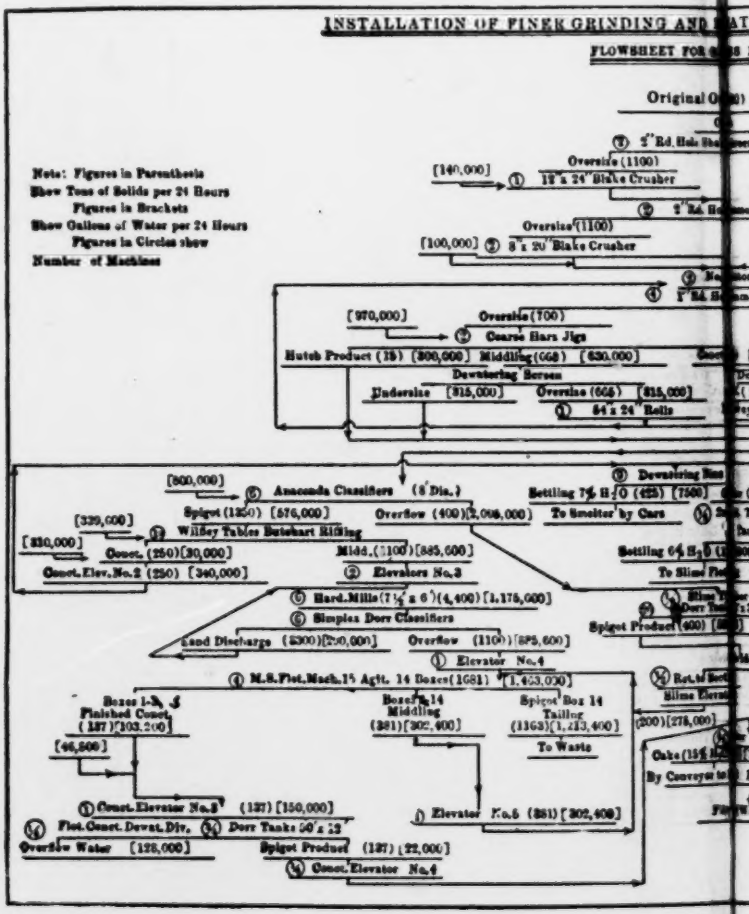
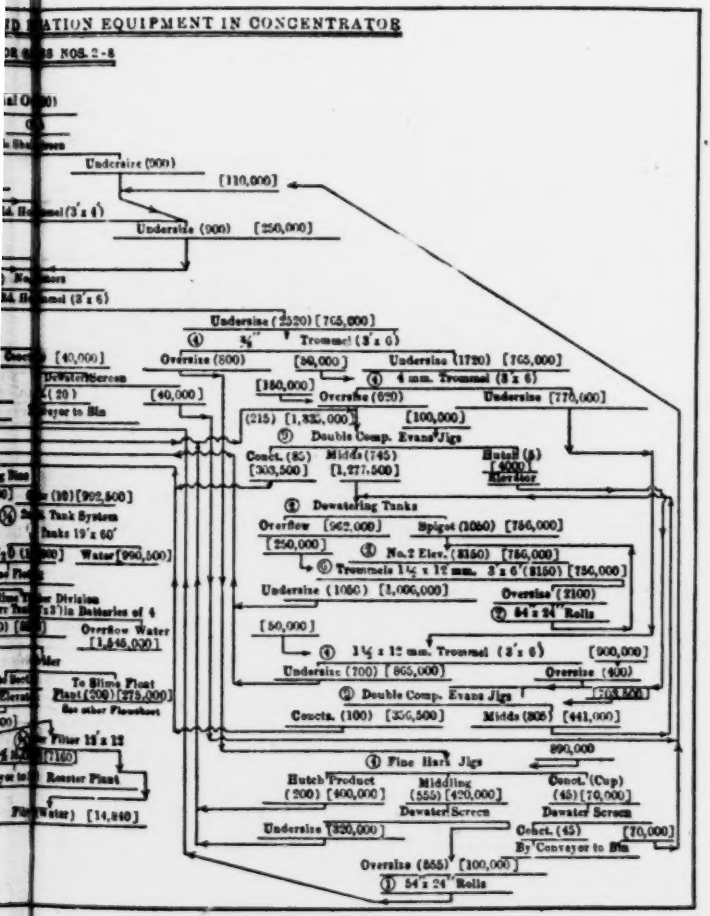


FIG.

Filed May 18, 1917. Geo. W. Sprou

5343–44

's Exhibit No. 242.



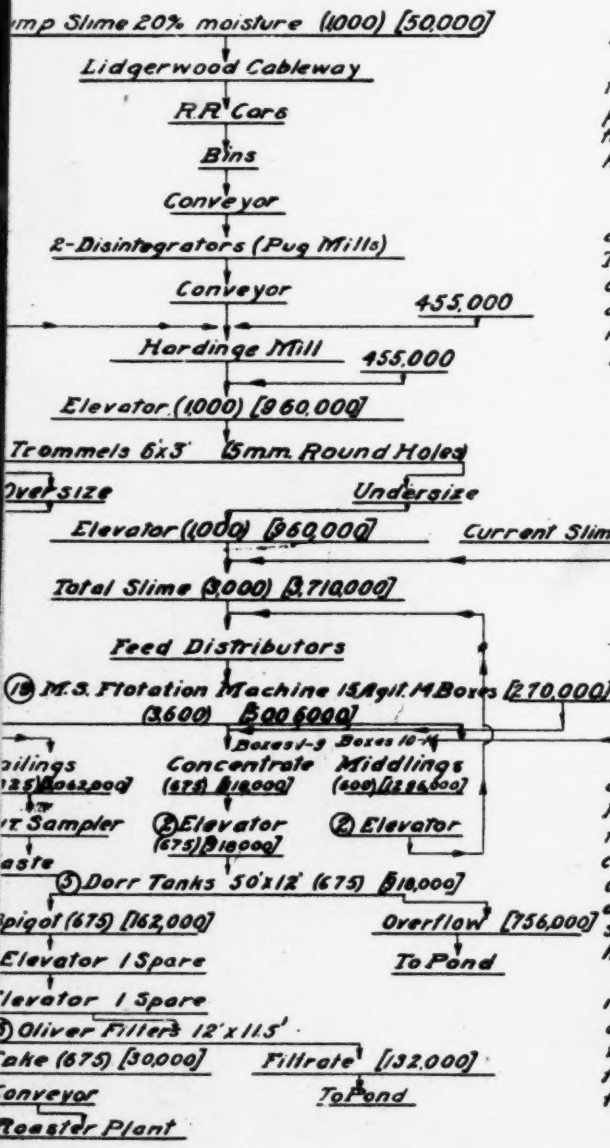
FLOTATION CONCENTRATION AT ANACONDA, MONT.

Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 243.

ANACONDA COPPER MINING CO.

SLIME FLOTATION PLANT AT ANACONDA



Notes:-

This flow sheet shows the current slime and pond slime mixed together for treatment. They may, however, be treated separately.

The figures in circles denote the number of machin Those in brackets, the number of gallons of water per 24 hour and those in parenthesis, the number of tons of solids in 24 hours.

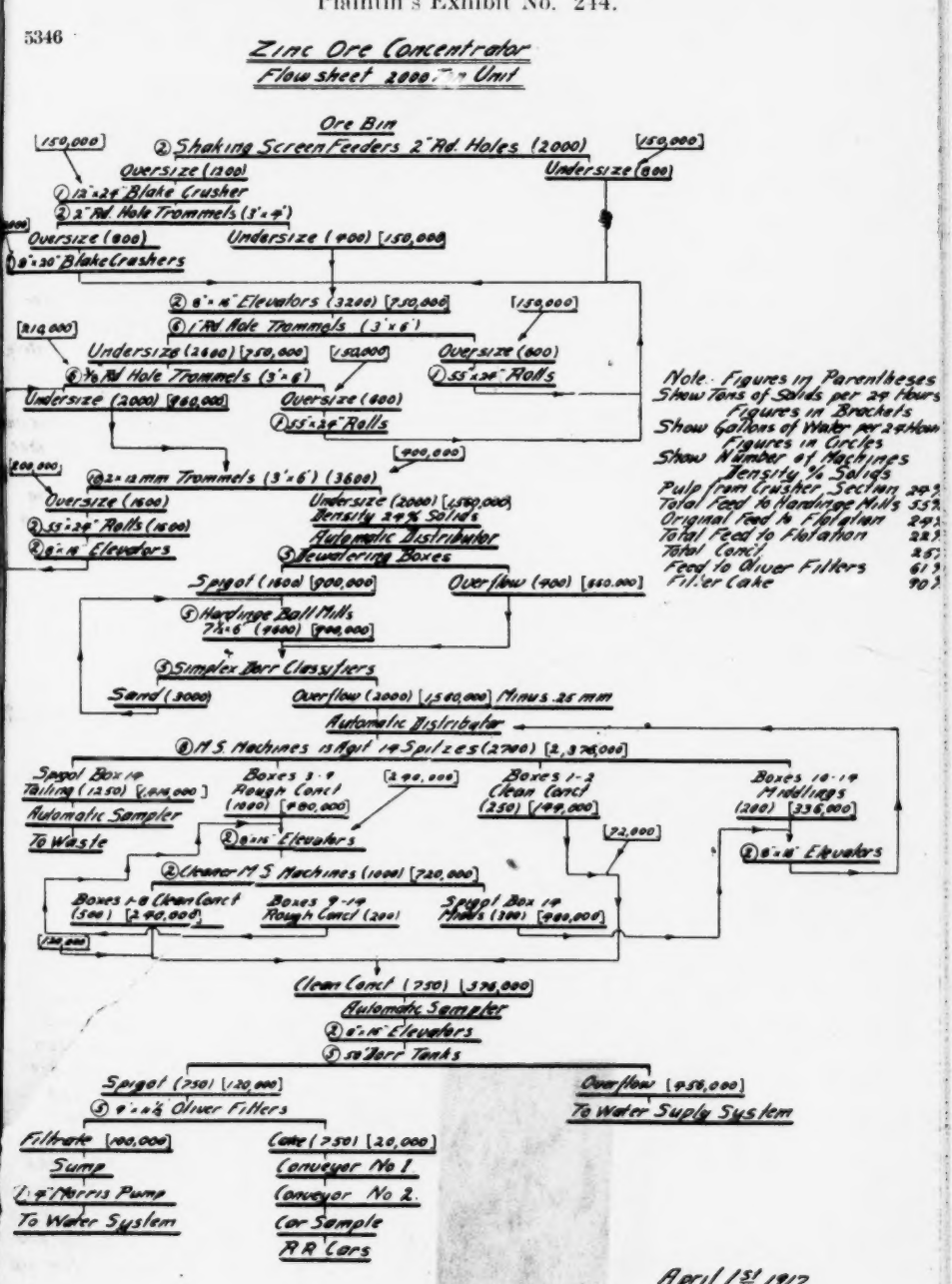
The following quantities of reagents will be used. H_2SO_4 60°B, abt. 12 lbs. per ton of solids. Crude wood creosote, abt. 2.5 lbs. per Ton of solids. Kerosene sludge acid, abt 2.5 lbs. per ton of solids. The pulp will be heated to abt. 60° to 70°F.

Cooling water from the roaster plant at a temperat abt. 175°F., will be added t the slimepulp bringing th temperture of the latter u to abt. 70° F.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 214.

5346



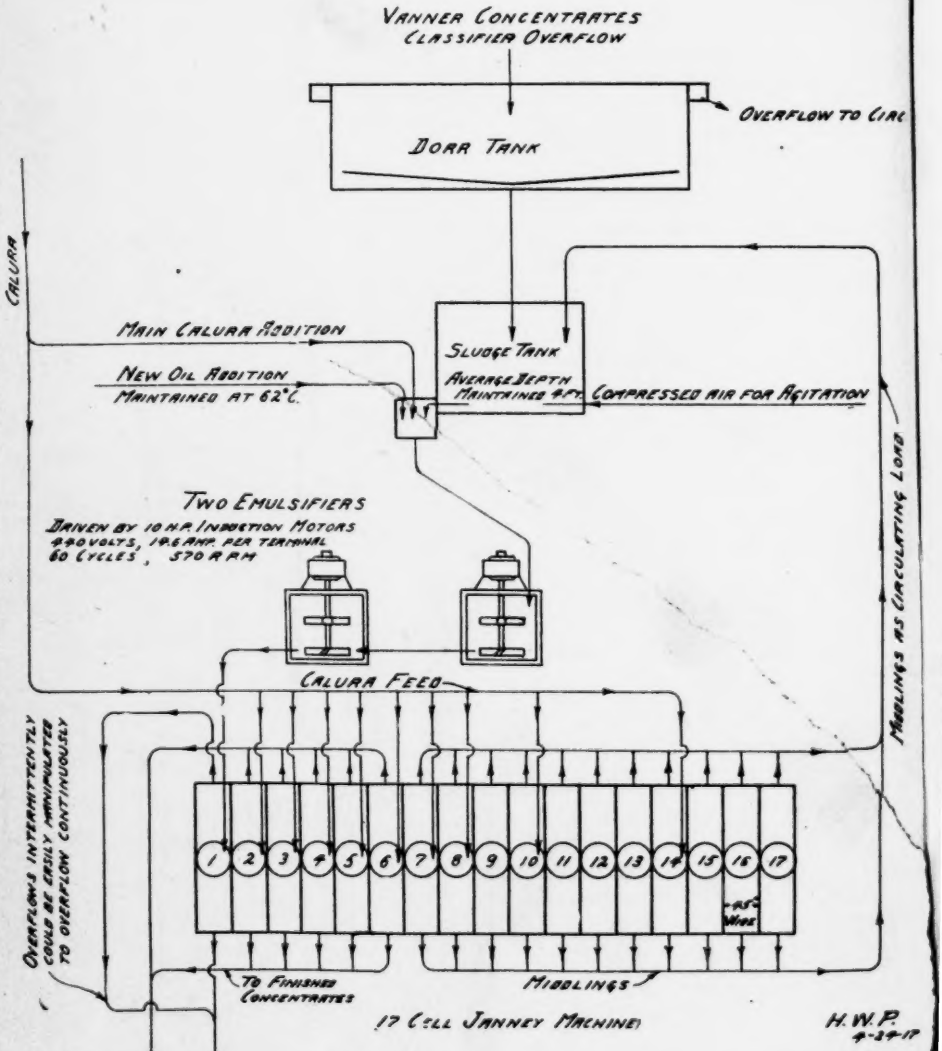
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5347-48-49

PLAINTIFF'S EXHIBIT NO. 245

FLOW SHEET—MAGNA MILL—UTAH COPPER COMPANY FLOTATION SECTION

PROF FULTON & PART
VISIT OF APRIL 23



(Here follows Plaintiff's Exhibit 246, marked pages 5350 and 5351.)

Plaintiff's E

5350

Flow Sheet T

Fresh Water From Hamilton Ranch
Fresh Water To Hill
72
69
Classifier Spigot Disch.
No 1.
No 4
No 5
NOMENCLATURE
1-Grade Ore Bin 400 Tons Capacity
2-1 Air Gate
3-1 Shaking Screen Feeder 5'x 20' 3 Openings
4-1 Farrell Crusher 8'x 30' 3" -
5-1 Steel Elevator No 0
6-1 Symons Rolsorting Screen 3'x 8' 2 Openings
7-1 " 8"x 36" Crusher 36 = 3/4" Product
8-1 Belt Conveyor 24" 196 F.P.M.
9-1 Secondary Ore Bin 400 Tons
10-2 Apron Feeders 24"
11-1 Belt Conveyor 20"
12-1 " " 50 " 555 "
13-2 Gerfield Rolls 54"x18"
14-1 Bucket Elevator No 1 with 64 Ft Cts. 66 FPM.
15-2 Impact Screens 55 RPM 2 3/8" mm Openings
16-3 Electric Samplers
17-1 Mechanical Distributor 8 Spigots
18-8 Wilfley Roughing Tables No 6. 253 RPM
19-3 #6 3/8" Schlocklassifiers 280 RPM 8 Spigots
20-1 Bucket Elevator No 2 127 FT Cts. 804 F.P.M
21-1 " " 50 " 555 "
22-1 Distributor
23-1 Table Mill No 7 5 FT x 9 FT.
24-1 Hardinge Mill 6 FT x 6 FT 249 RPM.
25-1 Bucket Elevator No 4 58 FT Cts. 502 FPM
26-1 Distributor 8 Spigots
27-8 James Sand Tables No 3. 255 RPM
28-1 Bucket Elevator No 5. 80 Ft Cts. 400 FPM
29-1 Carlon Screen, 18 mesh
30-1 Double Compound Jig
31-1 Pulverizing Box
32-1 A H S Classifier. 40 Tons Capacity
33-5 Wilfley Tables No 6 - 255 R.P.M.
34-1 James Table No 3 - 262 R.P.M
35-10 Distributing Box
36-2 Akins Classifiers 45" 7 R.P.M
37-1 Dorr Classifier 6 1/2 x 40 25 Strokes P.M.
38-1 Hardinge Mill 6 x 20 249 R.P.M. 35 Balls each
39-1 Dorr Thickener 24 x 16 Rakes 1/2 R.P.M
40-1 Bucket Elevator No 11. 66 Ft Cts 555 F.P.M
41-2 Sludge Tanks 6 x 10 - 138 R.P.M.
42-1 Roughter Flot Machine, 14 Cells.
43-1 Bucket Elevator No 12. 46 Ft Cts. 0 RPM.
44-1 Bucket Elevator No 1 Rock. 6 Cells
45-1 Bucket Elevator No 12. 66 Ft Cts. 3 Cells
46-1 Dorr Thickener Rock. 6 Cells

187—Rec.

Filed May 18, 191

COP

T's Ex. No. 246.

5351-52

eet for Butte Mill.

Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

COPY BOUND CLOSE IN CENTER

353

Plaintiff's Exhibit No. 247.

TIMBER BUTTE MILLING CO
BUTTE MONT.
FLOTATION OIL CONSUMPTIONS AND ACID CONSUMPTIONS

DATE	FLOTATION OIL		FLOTATION ACID		OILS USED TIMBER BUTTE MILLING CO'S NUMBERS
	POUNDS PER TON OF ORIGINAL FEED	POUNDS PER TON OF FLOTATION FEED	POUNDS PER TON OF ORIGINAL FEED	POUNDS PER TON OF FLOTATION FEED	
AUGUST-1914	.54	.60	9.77	10.84	No- 6, 140.
SEPTEMBER 1914	.49	.54	9.18	10.15	No- 6, 10, 140
OCTOBER-1914	.51	.56	9.03	9.99	No- 6, 10, 140
NOVEMBER 1914	.68	.78	9.41	10.73	No- 6, 10.
DECEMBER 1914	.76	.82	8.61	9.29	No- 6, 10.
3 MONTHS YEAR-1914	.61	.66	9.38	10.17	
JANUARY-1915	.81	.87	7.70	8.36	No. 6, 10.
FEBRUARY-1915	.69	.73	5.56	5.89	No- 6, 10, 12, 50, 90.
MARCH-1915	.71	.75	5.11	5.43	No- 6, 10, 12, 52, 88, 90, 160.
APRIL-1915	.85	.94	6.45	7.13	No- 6, 10.
MAY-1915	.85	.93	8.17	8.87	No- 6, 10, 87.
JUNE-1915	.65	.70	8.69	9.38	No- 10, 87
JULY-1915	.84	.90	17.06	18.22	No- 6, 10, 87, 89, 171, 174,
AUGUST-1915	.83	.90	12.91	13.86	No- 10, 89, 174, 192.
SEPTEMBER 1915	1.40	1.49	15.94	17.03	No- 10, 156, 174, 191, 192.
OCTOBER-1915	1.66	1.82	8.82	9.66	No- 170, 174, 191, 192
NOVEMBER 1915	1.10	1.19	8.16	8.79	No- 6, 21, 23, 87, 110, 174, 192.
DECEMBER 1915	1.34	1.46	9.67	10.53	No- 6, 21, 23, 87, 110, 192.
YEAR-1915	.97	1.05	9.22	9.94	
JANUARY-1916	1.27	1.36	13.74	14.70	No- 23, 87, 89, 174.
FEBRUARY 1916	.54	.58	12.20	13.09	No- 23, 170A.
MARCH 1916	.46	.49	9.77	10.37	No- 170A, 192.
APRIL-1916	.56	.59	10.93	11.57	No- 170A, 192
MAY-1916	.56	.59	10.51	11.11	No- 170A, 191, 192.
JUNE-1916	.51	.55	7.72	8.18	No- 87A, 170A, 191, 192.
JULY-1916	.66	.70	8.83	9.21	No- 170A, 191, 192, 270.
AUGUST-1916	.62	.67	7.54	8.12	No- 87A, 170A, 192
SEPTEMBER 1916	.73	.78	7.83	8.37	No- 87A, 23.
OCTOBER-1916	.68	.73	7.31	7.81	No- 87A, 171.
NOVEMBER 1916	.72	.79	8.43	9.23	No- 87A, 171
DECEMBER 1916	.59	.64	9.03	9.78	No- 87A, 171
YEAR-1916	.65	.70	9.53	10.19	
JANUARY 1917	.67	.73	9.40	10.36	No 87A, 171.
FEBRUARY 1917	.97	1.06	8.19	8.93	No- 87A, 171 176, 292.
MARCH 1917	.81	.89	11.04	12.15	No- 170A, 171, 87A.
3 MONTHS YEAR-1917	.80	.88	9.66	10.61	

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Flotation Oils of Timber Butte Milling Co.

	Producer.	Kind of oil.
T. B. No. 6	Georgia Pine Turpentine Co.	Crude Turpentine L. O. 3.
T. B. No. 10	United Naval Stores Co.	Pine Oil, M. S. No. 18.
T. B. No. 12	Minerals Separation	No. 20 Pine Oil.
T. B. No. 21	Georgia Pine Turpentine Co.	Carolina Oil of Tar.
T. B. No. 23	Georgia Pine Turpentine Co.	Fayetteville Wood Creosote.
T. B. No. 24	Georgia Pine Turpentine Co.	Carolina Oil of Tar, Special.
T. B. No. 50	United Naval Stores Co.	Pine Oil.
T. B. No. 52	United Naval Stores Co.	Turpentine "C".
T. B. No. 80	Pensacola Tar & Turpentine Co.	No. 200 Wood Creosote or C. P. Pine Tar.
T. B. No. 85	Pensacola Tar & Turpentine Co.	No. 1000-Crude Wood Oil.
T. B. No. 87	Pensacola Tar & Turpentine Co.	No. 75 Crude Turpentine.
T. B. No. 87-A	Pensacola Tar & Turpentine Co.	No. 80 Pine Oil, Crude.
T. B. No. 88	Pensacola Tar & Turpentine Co.	Pine Oil D. O. Pure.
T. B. No. 89	Pensacola Tar & Turpentine Co.	No. 19 Pine Oil.
T. B. No. 90	Mackie Pine Products Co.	No. 3 Pine Oil.
T. B. No. 110	Standard Oil Company	Cal. Richmond Fuel Oil.
T. B. No. 131	Cleveland Cliffs Co.	Refined Hardwood Creosote "XX".
T. B. No. 132	Cleveland Cliffs Co.	Refined Hardwood Creosote No. 2.
T. B. No. 140	C. T. Perry & Co.	Oleic Acid.
T. B. No. 156	Barrett Mfg. Co.	No. 4 Coal Tar Creosote.
T. B. No. 157	Barrett Mfg. Co.	Coal Tar Creosote.
T. B. No. 160	Newport Turpentine & Rosin Co.	Pure S. D. Pine Oil.
T. B. No. 170	General Naval Stores Co.	No. 9 Pine Tar Oil.
T. B. No. 170-A	General Naval Stores Co.	No. 1214 Pine Oil.
T. B. No. 171	General Naval Stores Co.	No. 5 Pure S. D. Pine Oil.
T. B. No. 174	General Naval Stores Co.	No. 8 Pine Tar Oil.
T. B. No. 174-A	General Naval Stores Co.	No. 814 Pine Tar Oil.
T. B. No. 176	General Naval Stores Co.	No. 17 Oil, Hard Wood Creosote.
T. B. No. 191	Chesapeake Oil Co.	No. 2 Pine Oil.
T. B. No. 192	Chesapeake Oil Co.	No. 3 Flotation Oil—Pine Oil.
T. B. No. 270	Union Oil Company	Kerosene Acid Sludge.
T. B. No. 292	C. G. Betts Company	Refined Coal Tar.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

TIMBER BUTTE MILLING CO.

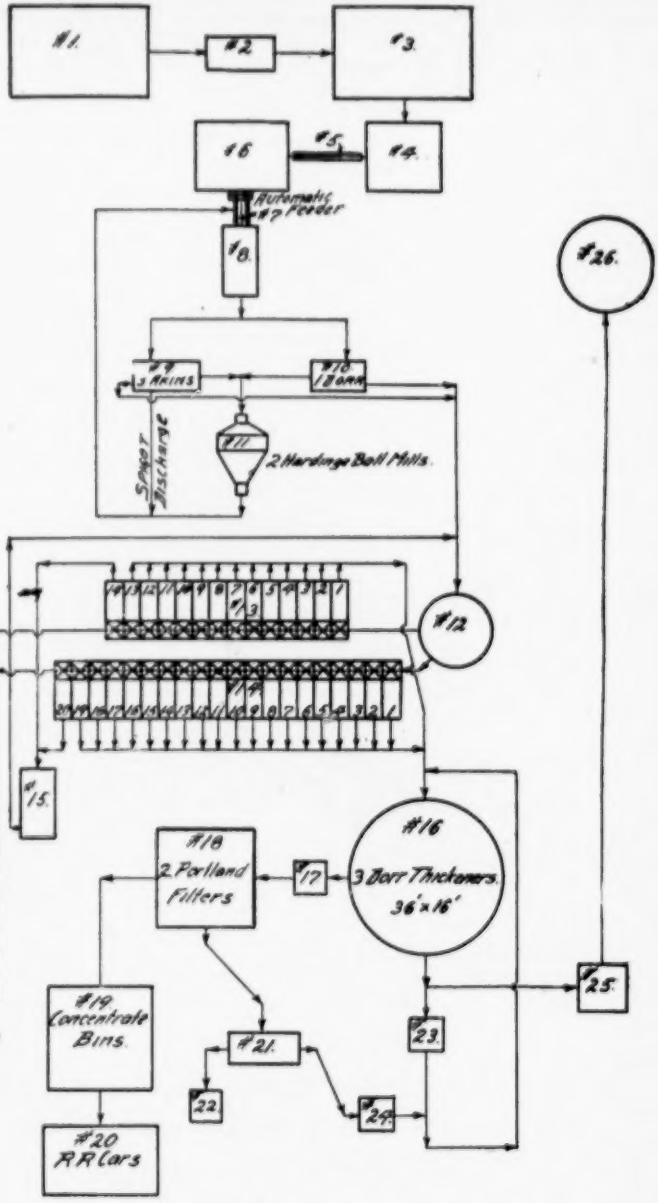
BUTTE, MONTANA

Comparison of Yearly Metallurgical Results.

Figures Based on Mill Weights and Assays.

	Original Mill Feed		Gravity Concentrates			Flotation Feed		Flotation Conc.		Total Mill Tailings		Recovery of Zinc in Original Mill Feed				Estimated Recovery of Zn in Flot. Fd.	
Date	Tons	Assay % Zinc	Zinc Conc. Tons	Copper Iron Conc. Tons	Lead Conc. Tons	Tons	Assay % Zinc	Tons	Assay % Zinc	Tons	Assay % Zinc	% Zinc Recovered in fine & coarse Zinc Conc. by weights and assays of feed and cond's.	% Zinc recovered in fine & coarse Zinc Conc's by settling and concs.	% Zinc recovered in all concs. by weights and assays of feed and concs.	% Zinc recovered in all conc's by settling and concentrates	% Zinc recovered in flot. concs. by flotation feed and concs.	% Zinc recovered in flot. concs. by settling and flot. concs.
Year 1915	160461.4425	.1723	1869.4235	1389.8500	340.3300	148036.8395	.1477	39486.3330	51.359	108550.5000	1.076	94.52	84.46	95.71	95.85	94.63	94.56
Year 1916	201455.0305	.1385	1211.8405	975.7205	681.7100	187677.7595	.1232	39140.1825	50.590	148537.5770	.768	94.17	84.66	95.26	95.75	93.94	94.55
Jan. Feb. Mar. 1917	41856.1680	.1742 6	351.7.4860	287.1260	158.7295	37892.8265	.1423	9742.6000	54.474	28250.2265	.714	97.17	96.15	98.31	97.27	97.72	96.34
Years 1915-1916 Jan. Feb. Mar. 1917	403872.6418	.1513 1	2633.17500	2652.6965	1180.7685	373707.4259	.1292	88369.1215	51.362	285338.3015	.880	94.68	84.75	95.82	95.88	94.67	94.76

2380 Plaintiff's Exhibit No. 249.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

TIMBER BUTTE MILLING COMPANY.
BUTTE-MONTANA.
TESTING DEPARTMENT.
FLOW SHEET No 2. COPPER SECTION EFFECTIVE APRIL 1917.
DRAWN BY J. Falco Smith. APPROVED BY

5357 Defendant's Exhibit No. 251.

Utah Copper Company,

Arthur Plant,

Experimental and Research Department.

Determinations on Magna Flotation Products for Butte & Sup. Litigation Sample No. 3, Feed from Dorr Thickener.

Weight of sample submitted to laboratory (H_2O plus solids) Gms.	1,966.00
Weight of wash water, Gms.	265.00
Weight of original feed (H_2O plus solids), Gms.	1,701.00
Weight of water in original feed sample, Gms.	919.00
Weight of solids in original feed sample, Gms.	782.0
Per cent solids in original feed sample	45.97
Per cent water in original feed sample	54.03
Pounds feed delivered per second (H_2O plus solids)	28.857
Pounds feed delivered per 24 hours	2,493,244.800
Pounds solids delivered per 24 hours	1,146,144.630
Tons solids delivered per 24 hours	573.072
Tons water delivered per 24 hours	673.550

Assay Analysis.

Per cent total copper	7.175
Per cent sulphide copper	7.095
Per cent iron	8.30
Per cent insoluble	69.00

Oil Analysis.

Total weight of sample (Gms.)	782.0
Total weight of oil content (Gms.)	.1270
Pounds oil per ton	.32

Page 4.

No. 2 Sample (Circulating Pulp).

Weight of material in bottle (H_2O plus solids) Gms.	2,279.5
Weight of wash water	390.0
Weight of original sample (H_2O plus solids)	1,889.5
Weight of original sample (Solids)	408.7
Weight of original sample (Water)	1,480.8
Per cent solids in circulating pulp	21.63
Pounds pulp circulating per 24 hours	1,061,078.40
Pounds solids circulating per 24 hours	229,511.26
Tons solids circulating per 24 hours	114.756
Tons H_2O circulating per 24 hours	388.298

Assay Analysis.

Per cent total copper	16.700
Per cent sulphide copper	16.435
Per cent iron	21.50
Per cent insoluble	27.50

Oil Analysis.

Total weight of sample (Gms.)	408.7
Total weight of oil content (Gms.)	7.7375
Pounds oil per ton	37.86

5358 Utah Copper Company,

Arthur Plant,

Experimental and Research Department.

Determinations on Magna Flotation Products for Butte & Superior Litigation.

No. 6 Oil Sample.

(General.)

Net weight oil delivered in 30 seconds (sample), Gms.	1,926.000
Lbs.	4.243
Pounds oil delivered per 24 hours	12,220.416
Pounds oil per ton ore treated	21.324

Utah Copper Company,

Arthur Plant,

Experimental and Research Department.

Magna Sample No. 1-B, Machine No. 1, Spitz No. 1 Overflow.

Assay Analysis.

Per cent total copper	19.100
Per cent sulphide copper	18.980
Per cent iron	19.40
Per cent insoluble	27.30

Oil Analysis.

Total weight of sample (Gms.)	305.9065
Total weight of oil content (Gms.)	63.0640
Pounds oil per ton	412.31

A part of this sample was lost in handling in the physical laboratory.

Utah Copper Company,

Arthur Plant,

Metallurgical and Research Department.

Magna Sample No. 1-*C, Machine No.* 1, *Spitz No.* 2 *Overflow.*

Assay Analysis.

Per cent total copper	21.250
Per cent sulphide copper	21.200
Per cent iron	27.15
Per cent insoluble	12.20

Oil Analysis.

Total weight of sample (Gms.)	544.2500
Total weight of oil content (Gms.)	26.3290
Pounds oil per ton	96.75

5359 Utah Copper Company,

Arthur Plant,

Experimental and Research Department.

Magna Sample No. 1-*D, Machine No.* 1, *Spitz No.* 3 *Overflow.*

Assay Analysis.

Per cent total copper	22.200
Per cent sulphide copper	22.180
Per cent iron	27.20
Per cent insoluble	11.00

Oil Analysis.

Total weight of sample (Gms.)	696.8000
Total weight of oil content (Gms.)	19.4140
Pounds oil per ton	55.72

Utah Copper Company,

Arthur Plant,

Experimental and Research Department.

Magna Sample No. 1-E, Machine No. 1, Spitz No. 4 Overflow.

Assay Analysis.

Per cent total copper	23.000
Per cent sulphide copper	22.990
Per cent iron	26.60
Per cent insoluble	10.00

Oil Analysis.

Total weight of sample (Gms.)	875.55
Total weight of oil content	12.5720
Pounds oil per ton	28.72

Utah Copper Company,

Arthur Plant,

Metallurgical and Research Department.

Magna Sample No. 1-F, Machine No. 1, Spitz No. 5 Overflow.

Assay Analysis.

Per cent total copper	23.900
Per cent sulphide copper	23.830
Per cent iron	26.90
Per cent insoluble	9.30

Oil Analysis.

Total weight of sample (Gms.)	590.9970
Total weight of oil content (Gms.)	4.8438
Pounds oil per ton	16.39

The oil result obtained on this sample is doubtless low on account of an explosion that took place while making the oil determination which caused some loss of sample.

5360

Utah Copper Company,

Arthur Plant,

Metallurgical and Research Department.

Magna Sample No. 1-G, Machine No. 1, Spitz No. 6 Overflow.

Assay Analysis.

Per cent total copper	23.800
Per cent sulphide copper	23.790
Per cent iron	26.20
Per cent insoluble	11.00

Oil Analysis.

Total weight of sample (Gms.)	397.2760
Total weight of oil content (Gms.)	5.2463
Pounds oil per ton	26.41

Utah Copper Company,

Arthur Plant,
Metallurgical and Research Department.

Oily Concentrate.
Magna Sample No. 8-B, Machine No. 1, Spitz No. 10, Dark Color

Assay Analysis.

Per cent total copper	18.800
Per cent sulphide copper	18.480
Per cent iron	16.30
Per cent insoluble	32.10

Oil Analysis.

Total weight of sample (Gms.)	28.9530
Total weight of oil content (Gms.)	2.6630
Pounds oil per ton	183.95

Utah Copper Company,

Arthur Plant,

Metallurgical and Research Department.

Magna Sample No. 8-A, Machine No. 1, Spitz No. 10, Light Color Froth.

Assay Analysis.

Per cent total copper	12.250
Per cent sulphide copper	11.970
Per cent iron	11.40
Per cent insoluble	49.70

Oil Analysis.

Total weight of sample (Gms.)	19.3450
Total weight of oil content (Gms.)	.6570
Pounds oil per ton	67.94

.5361

Utah Copper Company,

Arthur Plant,

Metallurgical and Research Department.

Magna Sample No. 1-A, Machine No. 1, Combined Concentrate.

Assay Analysis.

Per cent total copper	25.650
Per cent sulphide copper	25.570
Per cent iron	22.40
Per cent insoluble	15.40

Oil Analysis.

Total weight of sample (Gms.)	493.9315
Total weight of oil content (Gms.)	11.5778
Pounds oil per ton	46.88

No. 11 Tailing Sample (Cut No. 1).

Weight of material in bottle (original sample and wash H_2O) Gms.	2,893.0
Weight of wash water, Gms.	130.0
Weight of original sample, Gms.	2,763.0
Weight of H_2O decanted, Gms.	1,979.0
Weight of residual pulp, Gms.	914.0

Weight of solids in residual pulp, Gms.	681.5
Weight of H_2O in residual pulp, Gms.	232.5
Total weight of H_2O in original sample	2,081.5
Per cent solids in original sample	24.67

Assay Analysis.

Per cent total copper	.165
Per cent sulphide copper	.140
Per cent iron	1.85
Per cent insoluble	90.80

Oil Analysis.

Total weight of sample (Gms.)	681.50
Total weight of oil content (Gms.)	2.2480
Pounds oil per ton	6.60

No. 11 Tailing Sample (Cut No. 2).

Weight of material in bottle (original sample and wash H_2O), Gms.	2,841.6
Weight of wash water, Gms.	100.0
Weight of original sample	2,741.6
Weight of H_2O decanted, Gms.	1,937.0
Weight of residual pulp, Gms.	914.6
Weight of solids in residual pulp, Gms.	673.0
Weight of H_2O in residual pulp, Gms.	241.6
Total weight of H_2O in original sample, Gms.	2,078.6
Per cent solids in original sample	24.55

Assay Analysis.

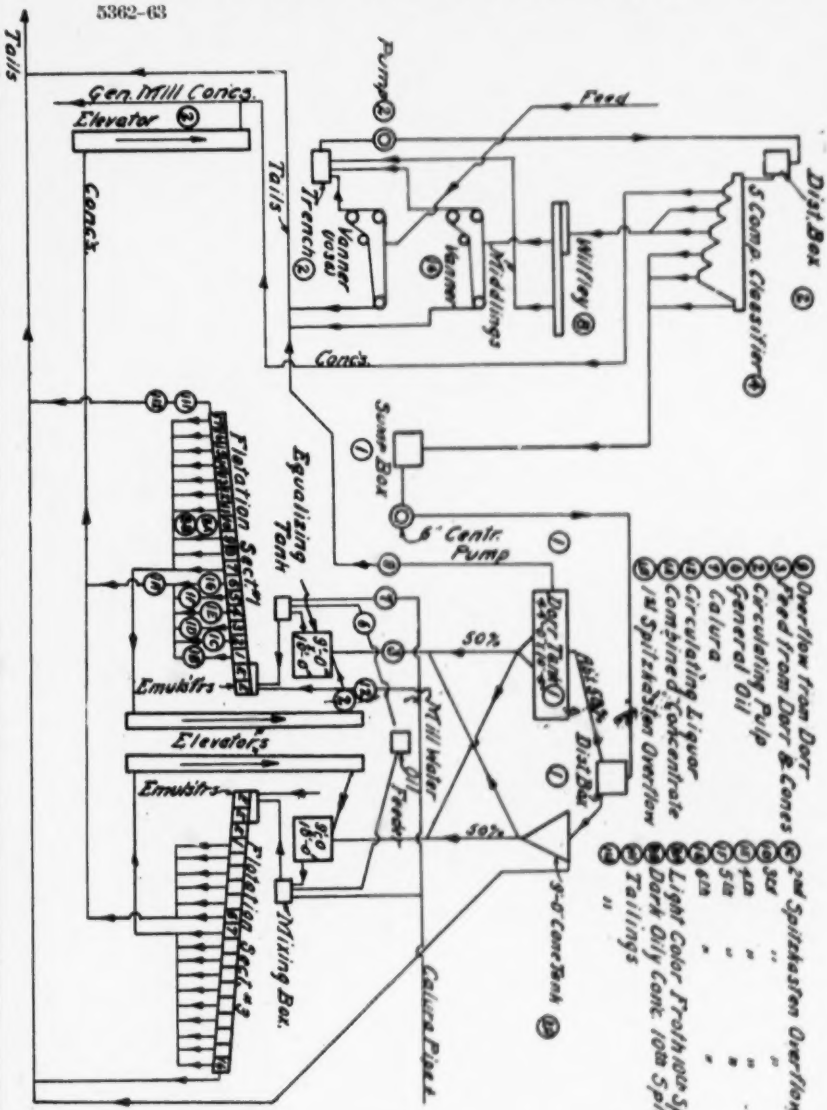
Per cent total copper	.155
Per cent sulphide copper	.130
Per cent iron	1.80
Per cent insoluble	88.00

Oil Analysis.

Total weight of sample (Gms.)	673.0
Total weight of oil content (Gms.)	1.9345
Pounds oil per ton	5.75

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5362-63



Flow Sheet For Flotation Plant and as operating on April 21-17.

Utah Copper Co- Magna Plant.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follows Plaintiff's Exhibit 252, marked pages 5364 and 5365.)

Plaintiffs' Exhibit No. 252.

BUTTE AND SUPERIOR MILL
VISIT OF MINERALS SEPARATION PARTY APRIL 29TH, 1917
TEST RUN 1:00 TO 5:00 P. M.

PRODUCT	DRY WEIGHT		ZINC		TOTAL OILS RECOVERED			VOLATILE OILS RECOVERED		NON-VOLATILE OILS RECOVERED	
	Total in 4 hr. Tons	Per cent of Heads	Assay %	Recovery % of total in Conc. & Tails	Total in 4 hr. run Lbs.	Lbs. per ton of Product	Per cent of total Oil Feed in 4 hours	Lbs. per Ton of Product	Per cent of total Volatile Oil recovered in Concts. and Tails	Lbs. per Ton of Product	Per cent of Total Non-Volatile Oil Recovered
Concentrates Sharps	31.37	11.9	46.9	48.8	715	22.8	10.5	10.6	12.29	12.2	10.80
Concentrates Slimes	28.79	10.9	41.8	39.9	2689	93.4	39.5	49.2	52.34	44.2	35.89
Concentrates Total	60.16	22.8	44.5	88.7	3404	56.6	50.0	29.1	64.63	27.5	46.69
Concentrates from B. & S. figures	(60.16)		(45.2)	(89.5)	(3766)	(62.6)	(54.2)				
Tailings Sharps	111.40	42.3	1.49	5.5	33	0.296	0.5	0.172	0.71	0.124	0.39
Tailings Slimes	91.97	34.9	1.91	5.8	2814	30.6	41.3	10.2	34.66	20.4	52.92
Tailings Total	203.37	77.2	1.68	11.3	2847	14.00	41.7	4.7	35.37	9.3	53.31
Tailings from B. & S. figures			(1.57)	(10.5)	(2725)	(13:4)	(39.2)				
Heads Calc' (Conc. plus Tails)	263.53	100.00	11.44	100.0	6251	23.7	91.7	10.3	100.0	13.4	100.0
from B. & S. figures	(263.53)		(11.53)		(6491)	(24.63)	(93.4)				

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5366–7 Plaintiff's Exhibit No. 253.

Utah Copper Samples.

	% Copper	Weights of products calculated from assays ton unit.	Indicated copper recovery.	Oil % upon products.	Recovery of oil fed 1.06% or 21.15 lbs. per ton.
Heads	.7.4	2000 lb.			
Concentrates	26.3	550 lb.	97.9%	Vol. .... .67% Nom V... 2.14	73.1%
				Total.. 2.81	
Tailings	.2	1450 lb.		Vol. .... .039% Nom V... .160	13.6%
				Total.. .199	
Total					86.7%
Skimmings 1st Spitzkasten	19.7			Total oil 26.24%	
Concentrates from 2nd Spitzkasten	21.75			Total oil 4.87%	

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit
No. 254.

Cataract Machine

May 3, 1917
Scale 6 = 1 Ft.

Position of this cover adjustable, but it was partly rusted into position as shown.

17 Baffles

Copy to scale of Photographed picture of Cataract Machine. Internal outline only drawn Inside diameter the same as on Dwg. of Deff's Machine & rest in proportion.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Plaintiff's Exhibits Nos. 255 and 256, marked pages 5370-1 and 5372-3.)

Plaintiff's Exhibit No. 255.

MINERALS SEPARATION CO. LIMITED ET AL VS. BUTTE & SUPERIOR MINING CO.

Referring to Defendant's Exhibit # 29—Chino Copper Company—Retreatment of Vanner Concentrates.

Mr. Wick's Evidence Q. 25 and Q. 26.

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrates			Recovery % Cu.		Tailings				Loss of Cu. in Tailings per ton of Heading		Cost of Smelting Concentrate			Cost of Concentration		Total Increase of cost per ton of Heading	Oil Lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
	Tons	Assay % Cu.	Contents Lbs. Cu.		Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated By Contents	Given in Exh. 29	Tons By Difference	Contents Lbs. of Cu. By Difference	Assay % Cu.		Lbs.	Value if one lb. cu. in cone be worth 20c net to the Mill	Smelting Charge & Freight per ton of Concentrate	Total	Per ton of Heading to Flotation	Operating per ton of Heading	Cost per ton of Heading including loss in tails and Cost of Smelting			
												Calculated By Contents	Given in Exh. 29										
1916 3rd Quarter....	28894	7.01	3737981	3.94	6804	27.10	3687768	98.13	98.717	20090	70153	.175	.505	2.62	$ 0.524	$ 6.00	$ 40824	$ 1.523	$ a	$ a + 0.524 + 1.523 = a + 2.047		8.76	4.57
1916 October.....	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	6910	20578	.149	.200	2.10	0.420	"	17304	1.767	a	a + 0.420 + 1.767 a + 2.187		10.26	4.77
1916 Nov. 18, 19, 20	561	10.24	114694	2.95	190	29.28	111254	96.84	98.437	371	3629	.499	.244	6.47	1.294	"	1140	2.032	a + 15 for (Extra Oil) &c.	a + 0.15 + 1.294 + 2.032 = a + 3.476		23.70	6.34

Filed May 18, 1917 GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit No. 256.

MINERALS SEPARATION LIMITED ET AL. VS. BUTTE AND SUPERIOR MINING COMPANY.

Referring to Defendant's Exhibit No. 150. Ray Consolidated Copper Co. Retreatment of Vanner Concentrates Products. Mr. Engelmann's Evidence, Q. 32–37 and Q. 84.

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrate			Recovery		Tailings				Loss of Cu. in Tailings p. ton of Heading		Cost of Smelting Concentrates			Cost of Concentration			Oil lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
	Tons	Assay Cu. %	Contents Lbs. Cu.		Tons	Assay Cu. %	Contents Lbs. Cu.	% Cu. Calculated	% Cu. Given Exh. 150	Tons By Diff.	Contents Lbs. Cu. By diff.	Assay Cu % Calculated	Assay Cu % Given Exh. 150	Lbs.	If one lb. of copper in Concentrate be worth 20c net to the mill.	Smelting charge per ton of Concentrate	Total	Per Ton of Heading	Operating per ton of Heading	Total cost per ton of heading including loss in tails and Smelting charge	Total increase of cost per ton of Heading in 1st Q. 1917		
1916 4th Quartr.	27275	6.099	3527005	4.48	6086	26.38	3210974	96.51	96.52	21189	116031	0.274	0.273	4.25	0.85	$ 5.00	$ 30430	1.12	$ a	a + 65 + 1.12 = a + 2.99	$	3.54	
1917 1st Quartr...	28913	6.581	3776812	3.64	7953	22.76	3509556	95.12	95.42	20960	184256	0.439	0.413	4.37	1.27	5.00	39665	1.37	a + 0.15 (For extra oil)	a + .15 + .1 27 + 1.37 = a + 2.79	0.89	20.10	

NOTE.—There would also be an additional smelting loss in the second case owing to the larger amount of slag made.

Filed May 18, 1917. GEORGE W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5374–5 Plaintiff's Exhibit No. 257.

In the District Court of the United States for the District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.

Statement of Butte and Superior Copper Company, Limited, for the Month of January, 1916, Filed Pursuant to Order of Court Entered in Above Entitled Action on November 15th, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of January, 1916.

5376

1. Of the amount of ore treated in its oil flotation plant	49428.060	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	10535.210	"
3. Of the analysis and assay returns of heads in its oil flotation plant	12.4956%	Zn.
	.7744%	Pb.
	.238 %	Cu.
	1.3536%	Fe.
	1.4154%	Mn.
	73.1557%	Insol.
	5.3859	Oz. Ag.
	.0112	" Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	54.593%	Zn.
	2.991%	Pb.
	.620%	Cu.
	2.137%	Fe.
	.249%	Mn.
	8.580%	Insol.
	23.057	Oz. Ag.
	.0330	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant		$3.0583
6. Of the value per ton of concentrates recovered in its oil flotation plant		$101.164

5377 The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates....

1.2008%	Zn.
.0500%	Pb.
.065 %	Cu.
.8300%	Fe.
1.5500%	Mn.
90.48 %	Insol.
1.0600	Oz. Ag.
.00208	" Au.

5378 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

February, 1916.

Subscribed and sworn to before me this 19th day of February, 1916.

[SEAL.] C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5379 Plaintiff's Exhibit No. 258.

In the District Court of the United States for the District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.

Statement of Butte and Superior Copper Company, Limited, for the Month of February, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Action on November 15th, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of February, 1916.

5380

1. Of the amount of ore treated in its oil flotation plant	49,800.276	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	10,774.997	"
3. Of the analysis and assay returns of heads in its oil flotation plant	11.8580%	Zn.
	.7534%	Pb.
	.1645%	Cu.
	1.3998%	Fe.
	1.2018%	Mn.
	71.6222%	Insol.
	5.7921	Oz. Ag.
	.00956	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	53.940%	Zn.
	2.956%	Pb.
	.627%	Cu.
	2.069%	Fe.
	.273%	Mn.
	9.293%	Insol.
	23.016	Oz. Ag.
	.0338	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$2.5271	
6. Of the value per ton of concentrates recovered in its oil flotation plant	$93.567	

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the

filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

5381

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates.....

1.5034% Zn.
.0800% Pb.
.0450% Cu.
.8500% Fe.
1.500 % Mn.
90.59 % Insol.
1.0100 Oz. Ag.
.00209 Oz. Au.

5382 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of February, 1916.

ALF. C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires Sept. 5, 1916.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5383 Plaintiff's Exhibit No. 259.

In the District Court of the United States for the District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.

Statement of Butte and Superior Copper Company, Limited, for the Month of March, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Action on November 15th, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of March, 1916.

5384

1. Of the amount of ore treated in its oil flotation plant	52,089.4335	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	12,199.0195	"
3. Of the analysis and assay returns of heads in its oil flotation plant	13.7634%	Zn.
	.7238%	Pb.
	.1572%	Cu.
	1.2916%	Fe.
	1.2720%	Mn.
	71.7590%	Insol.
	5.8663	Oz. Ag.
	.0089	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	53.752%	Zn.
	3.046%	Pb.
	.598%	Cu.
	1.971%	Fe.
	.295%	Mn.
	10.107%	Insol.
	23.388	Oz. Ag.
	.0347	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$2.6968	
6. Of the value per ton of concentrates recovered in its oil flotation plant	$93.627	

5385 The figures set forth under the foregoing six paragraphs are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates.....

1.3138%	Zn.
.0600%	Pb.
.0330%	Cu.
.8400%	Fe.
1.5300%	Mn.
90.4000%	Insol.
.9700	Oz. Ag.
.0025	Oz. Au.

5386 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages of weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of April, 1916.

ALF C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires Sept. 5, 1916.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5387 Plaintiff's Exhibit No. 260.

In the District Court of the United States for the District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.

Statement of Butte and Superior Copper Company, Limited, for the Month of April, 1916, Filed Pursuant to Order of Court Entered in Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Copper Company, Limited, and in compliance with the order of court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of April, 1916:

5388

1. Of the amount of ore treated in its oil flotation plant	50,115.6675	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	12,080.5145	tons
3. Of the analysis and assay returns of heads in its oil flotation plant	14.0828%	Zn.
	.8599%	Pb.
	.1936%	Cu.
	1.2723%	Fe.
	1.3087%	Mn.
	71.5644%	Insol.
	6.2552	Oz. Ag.
	.0107	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	53.353%	Zn.
	3.311%	Pb.
	.558%	Cu.
	2.043%	Fe.
	.352%	Mn.
	10.355%	Insol.
	23.713	Oz. Ag.
	.0347	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant		$2.8430
6. Of the value per ton of concentrates recovered in its oil flotation plant		83.7990

The figures set forth under the foregoing six paragraphs
5389 are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates..... 1.3810% Zn.
.0800% Pb.
.0400% Cu.
.7500% Fe.
1.4500% Mn.
91.1000% Insol.
.9200 Oz. Ag.
.00208 Oz. Au.

5390 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day of May, 1916.

C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5391 Plaintiff's Exhibit No. 261.

In the District Court of the United States for the District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR COPPER COMPANY, LIMITED, Defendant.

Statement of Butte and Superior Copper Company, Limited (Now Butte and Superior Mining Company), for the Month of May, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), and in compliance with the order of court entered in the above entitled cause on the 15th
5392 day of November, 1913, files the following statement showing an approximate estimate for the month of May, 1916:

1. Of the amount of ore treated in its oil flotation plant	50,688.330 Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	11,658.5905 "
3. Of the analysis and assay returns of heads in its — flotation plant	13.8251% Zn. .8454% Pb. .1798% Cu. 1.4238% Fe. 1.2746% Mn. 72.1681% Insol. 5.6426 Oz. Ag. .0110 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	54.650% Zn. 3.032% Pb. .578% Cu. 2.475% Fe. .256% Mn. 7.747% Insol. 22.976 Oz. Ag. .0337 Oz. Au.

5393

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$3.2337
6. Of the value per ton of concentrates recovered in its oil flotation plant	$65.27

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates.....

1.3509%	Zn.
.0600%	Pb.
.0500%	Cu.
.7800%	Fe.
1.5500%	Mn.
90.1400%	Insol.
.8800	Oz. Ag.
.0033	Oz. Au.

5394 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the cashier of the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day of June, 1916.

A. C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5395 Plaintiff's Exhibit No. 262.

In the District Court of the United States for the District of Montana.

No. 6. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of June, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and in compliance
5396 with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement showing an approximate estimate for the month of June, 1916:

1. Of the amount of ore treated in its oil flotation plant	48,474.8705 Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	10,830.4620 "
3. Of the analysis and assay returns of heads in its oil flotation plant	12.9759% Zn. .6248% Pb. .1553% Cu. 1.4105% Fe. 1.4237% Mn. 73.0231% Insol. 5.1841 Oz. Ag. .0089 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	54.579% Zn. 3.125% Pb. .586% Cu. 2.283% Fe. .260% Mn. 8.320% Insol. 22.154 Oz. Ag. .0361 Oz. Au.

5397

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$3.2105
6. Of the value per ton of concentrates recovered in its oil flotation plant	$49.44

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates.....

1.0766%	Zn.
.0800%	Pb.
.0400%	Cu.
.7500%	Fe.
1.7000%	Mn.
88.5500%	Insol.
.7300	Oz. Ag.
.0025	Oz. Au.

5398 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of July, 1916.

A. C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5399 Plaintiff's Exhibit No. 263.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of July, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and in compliance with the order of Court entered in the above entitled cause on the
5400 15th day of November, 1913, files the following statement showing an approximate estimate for the month of July, 1916:

1. Of the amount of ore treated in its oil flotation plant	45,874.287	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	8,685.416	"
3. Of the analysis and assay returns of heads in its oil flotation plant	11.4907%	Zn.
	.8030%	Pb.
	.1427%	Cu.
	1.6479%	Fe.
	1.8797%	Mn.
	73.6796%	Insol.
	4.6771	Oz. Ag.
	.0082	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	54.000%	Zn.
	3.168%	Pb.
	.611%	Cu.
	2.180%	Fe.
	.329%	Mn.
	8.706%	Insol.
	23.161	Oz. Ag.
	.030	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant		$3.64

5401

6. Of the value per ton of concentrates recovered in its oil flotation plant	$48.83

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates....

1.0760%	Zn.
.0600%	Pb.
.0300%	Cu.
.7600%	Fe.
2.0000%	Mn.
89.8400%	Insol.
.7400	Oz. Ag.
.00208	Oz. Au.

5402 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this — day of August, 1916.

——— ———,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires ——— —, ———.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5403 Plaintiff's Exhibit No. 264.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of August, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, showing
5404 an approximate estimate for the month of August, 1916:

1. Of the amount of ore treated in its oil flotation plant	31,733.120	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	7,502.243	"
3. Of the analysis and assay returns of heads in its oil flotation plant	13.4892%	Zn.
	.7759%	Pb.
	.1603%	Cu.
	1.7436%	Fe.
	1.8357%	Mn.
	70.3365%	Insol.
	6.2148	Oz. Ag.
	.0089	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	54.290%	Zn.
	2.912%	Pb.
	.575%	Cu.
	2.322%	Fe.
	.310%	Mn.
	8.862%	Insol.
	23.117	Oz. Ag.
	.040	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant		$4.8860
5405 6. Of the value per ton of concentrates recovered in its oil flotation plant		49.4500

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate, and not estimates....

1.0000%	Zn.
.0600%	Pb.
.0200%	Cu.
.5600%	Fe.
1.8500%	Mn.
90.5900%	Insol.
.8300	Oz. Ag.
.0013	Oz. Au.

5406 UNITED STATES OF AMERICA,
District of Montana, ss:

J. L. Bruce, being first duly sworn on oath, deposes and says:

That he is the Manager of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

J. L. BRUCE.

Subscribed and sworn to before me this — day of September, 1916.

LOUIS P. SANDERS,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 14th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5407 Plaintiff's Exhibit No. 265.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of September, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, showing
5408 an approximate estimate for the month of September, 1916.

1. Of the amount of ore treated in its oil flotation plant	48809.7815	Tons
2. Of the amount of concentrates recovered in its oil flotation plant	12694.2915	"
3. Of the analysis and assay returns of heads in its oil flotation plant	14.8415%	Zn.
	.9494%	Pb.
	.1534%	Cu.
	2.5475%	Fe.
	1.7308%	Mn.
	66.8589%	Insol.
	6.1882	Oz. Ag.
	.0058	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant	53.659%	Zn.
	3.167%	Pb.
	.509%	Cu.
	3.010%	Fe.
	.303%	Mn.
	8.672%	Insol.
	21.720	Oz. Ag.
	.0322	" Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$3.1725	
6. Of the value per ton of concentrates recovered in its oil flotation plant	$48.69	

5409 The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates....

1.0900%	Zn.
.0600%	Pb.
.0800%	Cu.
.8000%	Fe.
2.0000%	Mn.
88.4000%	Insol.
.7900	Oz. Ag.
.0020	Oz. Au.

5410 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof: that the approximate estimates therein set forth are true to the best of his knowledge, information and belief: that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive: that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of October, 1916.

ALF C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires October 2nd, 1919.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5411 Plaintiff's Exhibit No. 266.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of October, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of court entered in the above entitled cause on the
5412 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of October, 1916.

1. Of the amount of ore treated in its oil flotation plant	53541.866	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	14191.495	Tons.
3. Of the analysis and assay returns of heads in its flotation plant	15.1280%	Zn.
	1.1496%	Pb.
	.1969%	Cu.
	2.3807%	Fe.
	1.7144%	Mn.
	66.7682%	Insol.
	6.0501	Oz. Ag.
	.0062	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	53.414%	Zn.
	3.830%	Pb.
	.545%	Cu.
	2.587%	Fe.
	.280%	Mn.
	8.731%	Insol.
	21.595	Oz. Ag.
	.033	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$2.8268	

5413

6. Of the value per ton of concentrates recovered in its oil flotation plant $56.89

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates... 1.3140% Zn.
.0800% Pb.
.0400% Cu.
.6000% Fe.
1.8500% Mn.
90.2400% Insol.
.7800 Oz. Ag.
.0013 Oz. Au.

5414 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of November, 1916.

ALF C. KREMER,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires October 2nd, 1919.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5415 Plaintiff's Exhibit No. 267.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of November, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, show-
5416 ing an approximate estimate for the month of November, 1916.

1. Of the amount of ore treated in its oil flotation plant	50494.8475	Tons.
2. of the amount of concentrates recovered in its oil flotation plant	11398.124	Tons.
3. Of the analysis and assay returns of heads in its oil flotation plant	13.0008%	Zn.
	.7664%	Pb.
	.1450%	Cu.
	1.6273%	Fe.
	1.5276%	Mn.
	71.5711%	Insol.
	5.2188	Oz. Ag.
	.00949	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	53.524%	Zn.
	3.544%	Pb.
	.491%	Cu.
	2.487%	Fe.
	.307%	Mn.
	8.730%	Insol.
	21.749	Oz. Ag.
	.0313	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$3.5814	

5417

6. Of the value per ton of concentrates recovered in its oil flotation plant $55.3200

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates

.941%	Zn.
.050%	Pb.
.020%	Cu.
.660%	Fe.
1.850%	Mn.
91.030%	Insol.
.720	Oz. Ag.
.001254	Oz. Au.

5418 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of January, 1917.

C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5419 Plaintiff's Exhibit No. 268.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of December, 1916, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the
5420 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of December, 1916.

1. Of the amount of ore treated in its oil flotation plant	52,886.3455 Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	11,234.729 Tons.
3. Of the analysis and assay returns of heads in its flotation plant	12.1680% Zn. .7428% Pb. .1630% Cu. 1.7395% Fe. 1.4729% Mn. 71.0963% Insol. 5.2329 Oz. Ag. .0079 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	52.779% Zn. 3.241% Pb. .515% Cu. 2.291% Fe. .280% Mn. 11.065% Insol. 21.093 Oz. Ag. .027 Oz. Au.

5421

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$4.3060

6. Of the value per ton of concentrates recovered in its oil flotation plant..... $57.01

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates.....

1.124%	Zn.
.070%	Pb.
.030%	Cu.
.760%	Fe.
1.700%	Mn.
90.180%	Insol.
.880	Oz. Ag.
.008	Oz. Au.

5422 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of th.s from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of January, 1917.

C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5423 Plaintiff's Exhibit No. 269.

In the District Court of the United States for the District of Montana.

In Equity. No. 8.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of January, 1917, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company and in compliance with the order of Court entered in the above entitled
5424 cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of January, 1917.

1. Of the amount of ore treated in its oil flotation plant	46,048.870 Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	10,100.4635 Tons.
3. Of the analysis and assay returns of heads in its flotation plant	12.9230% Zn. 1.0180% Pb. .1780% Cu. 1.9858% Fe. 1.4932% Mn. 71.8252% Insol. 5.6810 Oz. Ag. .00855 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	48.820% Zn. 3.904% Pb. .477% Cu. 2.623% Fe. .343% Mn. 14.200% Insol. 19.092 Oz. Ag. .032 Oz. Au.

5425

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation	$6.2790
6. Of the value per ton of concentrates recovered in its oil flotation plant	$54.5000

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates....

2.6120%	Zn.
.0600%	Pb.
.0400%	Cu.
.6400%	Fe.
1.6000%	Mn.
88.4000%	Insol.
1.1200	Oz. Ag.
.0013	Oz. Au.

5426

UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of February, 1917.

C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5427 Plaintiff's Exhibit No. 270.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company (Formerly Butte and Superior Copper Company, Limited) for the Month of February, 1917, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company and in compliance with the order of Court entered in the above entitled
5428 cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of February, 1917.

1. Of the amount of ore treated in its oil flotation plant	43216.8605 Tons
2. Of the amount of concentrates recovered in its oil flotation plant	9980.6145 Tons
3. Of the analysis and assay returns of heads in its oil flotation plant	12.9875% Zn. .9091% Pb. .1699% Cu. 1.9109% Fe. 1.2430% Mn. 71.6749% Insol. 5.2422 Oz. Ag. .0097 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	45.6390% Zn. 3.6760% Pb. .5060% Cu. 2.7280% Fe .5680% Mn. 19.1930% Insol. 17.4720 Oz. Ag. .0275 Oz. Au.

5429

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$5.5544
6. Of the value per ton of concentrates recovered in its oil flotation plant	$50.084

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates.....

1.9560%	Zn.
.0800%	Pb.
.0380%	Cu.
.6200%	Fe.
1.5000%	Mn.
90.0000%	Insol.
.8500	Oz. Ag.
.0018	Oz. Au.

5430

UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of March, 1917.

C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5431 Plaintiff's Exhibit No. 271.

In the District Court of the United States for the District of Montana.

No. 8. In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly Butte & Superior Copper Company, Limited, Defendant.

Statement of Butte and Superior Mining Company for the Month of March, 1917, Filed Pursuant to Order of Court Entered in the Above Entitled Cause on November 15th, 1913.

Comes now Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of November, 1913, files the following statement, showing
5432 an approximate estimate for the month of March, 1917.

1. Of the amount of ore treated in its oil flotation plant	47202.599	Tons.
2. Of the amount of concentrates recovered in its oil flotation plant	10642.6505	Tons.
3. Of the analysis and assay returns of heads in its oil flotation plant	12.4893%	Zn.
	.8578%	Pb.
	.1598%	Cu.
	1.8901%	Fe.
	1.4681%	Mn.
	73.0481%	Insol.
	4.8032	Oz. Ag.
	.00584	Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation	47.207%	Zn.
	3.700%	Pb.
	.489%	Cu.
	3.000%	Fe.
	.400%	Mn.
	16.500%	Insol.
	18.240	Oz. Ag.
	.0267	Oz. Au.
5433 5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant	$6.0242	
6. Of the value per ton of concentrates recovered in its oil flotation plant	$43.81	

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates....

1.997%	Zn.
.115%	Pb.
.040%	Cu.
.800%	Fe.
1.650%	Mn.
89.600%	Insol.
.840	Oz. Ag.
.0012	Oz. Au.

5434-5 UNITED STATES OF AMERICA,
District of Montana, ss:

Chas. Bocking, being first duly sworn on oath, deposes and says: That he is the Assistant Manager of the Butte and Superior Mining Company, and makes this affidavit for and on behalf of said company: That the Butte and Superior Mining Company is the defendant in the foregoing action; That he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of April, 1917.
C. K. TUOHY,
Notary Public for the State of Montana,
Residing at Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Plaintiff's Exhibits Nos. 272 to 277, marked pages 5436-7, 5438-9, 5441-2, and 5443-4.)

Plaintiffs' Exhibit No. 272.

MINERALS SEPARATION, LIMITED, ET AL, VS. BUTTE & SUPERIOR MINING COMPANY

BUTTE & SUPERIOR MINING CO. FLOTATION PLANT RESULTS

Calculated from the Sworn Statements of the Manager to the Federal Court, Butte, Mont.

PERIOD	ORE DELIVERED TO PLANT			Ratio of Concentration	CONCENTRATES			Zinc Recovery Percent (By Contents)	TAILINGS					Oils	Other Reagents	COSTS — $		
	Tons	Assay % Zinc	Zinc Content Tons		Tons	Assay % Zinc	Zinc Content Tons		Tons (By Difference)	Zinc Contents Tons (By Difference)	Lbs. Zinc Per Ton of Hi-ads	Assay % Zinc Calculated	Assay % Zinc Given			Total	Per Ton Ore	Per Ton Concentrate
1916—October	53,542	15.128	8099.83	6.77	14191	53.414	7579.98	93.582	39,351	519.85	19.41	1.321	1.314			40,115	0.7492	2.8268
November	50,495	13.001	6564.47	4.43	11398	53.524	6100.67	92.929	39,097	464.18	18.39	1.187	0.941			40,821	0.8084	3.5814
December	52,886	12.168	6435.17	4.71	11235	52.779	5929.72	92.146	41,651	505.45	19.12	1.214	1.124			48,378	0.9148	4.3060
1916—Last Quarter	156,923	13.446	21099.85	4.26	36824	53.254	19610.37	92.941	120,099	1489.48	19.11	1.240	1.127			129,314	0.8241	3.5117
1917—January	46,049	12.923	5950.91	4.56	10100	48.820	4930.82	82.858	39,949	1020.09	44.30	2.838	2.612			63,418	1.3772	6.2790
February	43,217	12.988	5613.02	4.33	9981	45.639	4555.23	81.155	33,236	1057.79	48.95	3.183	1.956			55,438	1.2828	5.5544
March	47,203	12.489	5895.18	4.44	10643	47.207	5024.24	85.228	36,560	870.94	36.90	2.382	1.997			64,116	1.3583	6.0242
1917—First Quarter	136,469	12.793	17459.11	4.44	30724	47.228	14510.29	83.110	105,745	2948.82	43.22	2.789	2.192			182,972	1.3408	5.9553

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 273.

MINERALS SEPARATION, LIMITED, ET AL. VS. BUTTE AND SUPERIOR MINING COMPANY

FLOTATION PLANT RESULTS.

Calculated from the Sworn Statements of the Manager of the Butte and Superior Company to the Federal Court in Butte.

Comparisons made between the results of operation with excess oil with those of operation with small quantities. For this purpose periods have been chosen in which the headings to flotation were of as nearly equal Zinc assay as possible. Only the value of the Zinc has been taken into account. The sales value of the Zinc Concentrates has been calculated in all cases on the same terms and market price for spelter. See Appendix A. Figures for oil and acid taken from Defendant's Exhibit No. 158.

PERIOD.	Heading to Flotation			Concentrates			Tailings					Oils	Acid	Costs			Sales value of concentrates on equal terms as shown on Appendix A (Zinc only)			Profit	
	Tons	Assay % Zinc	Zinc Contents Tons	Tons	Assay % Zinc	Zinc Contents Tons	% Zn. Recovery (By Contents)	Tons (By difference)	Zn. Contents Tons (By difference)	Lbs. Zinc per ton of Heading	Assay % Zinc Calculated by Contents	Assay % Zinc Given	Per Ton of Heading	Per Ton of Heading	Per ton of Heading	Per ton of Concentrates	Total Cost	Per ton Heading	Per ton of Concentrates	Total	Per ton of Heading	Per ton of Concentrates
1916—January	49428	12.496	6176.52	10535	54.593	5751.37	93.117	38893	425.15	19.23	1.093	1.2008	about 1.7	about 5.00	$ 0.652	$ 3.0583	$ 32219	$ 10.36	$ 48.63	$ 512317	$ 9.71	$ 45.57
1917—March	47.03	12.489	5895.18	10643	47.207	5024.24	85.228	36560	870.90	36.90	2.382	1.997	about 22.0	about 10.00	1.3583	6.0242	64116	9.47	41.99	446900	8.11	35.97
Differences		.007			7.386		7.889			15.67	1.289				3.706	2.9659	31897	.89	6.64	65417	1.63	9.64
1916—June	48475	12.976	6290.12	10830	54.579	5910.91	93.972	37645	379.21	15.65	1.007	1.0766	about 1.7	about 5.00	0.7170	3.2105	34770	10.86	48.62	526535	10.14	45.41
1917—February	43217	12.988	5613.02	9981	45.639	4555.23	81.155	33236	1057.79	48.95	3.183	1.956	about 20.2	about 10.00	1.2828	5.5344	55438	9.37	40.58	405029	8.09	35.03
Differences		.012			8.940		12.817			33.30	2.175				0.5658	2.3439	20668	1.49	8.04	121526	2.05	10.38
1916—November	50495	13.001	6564.85	11398	53.524	6100.67	92.929	39097	464.18	18.39	1.187	0.941	about 1.5	about 5.0	0.8084	3.5814	40821	10.76	47.67	543343	9.96	44.09
1917—January	46049	12.923	5950.91	10100	48.820	4930.82	82.858	33236	1020.09	14.30	2.838	2.612	about 20.0	about 10.0	1.3772	6.2790	63418	9.53	43.44	438744	8.13	37.16
Differences		.078			4.704		10.071			25.91	1.651				0.5688	2.6976	22597	1.23	4.23	104599	1.81	6.93

The figures indicate that the modification of the operating with excess oil would cause a decrease of profit from the Zinc alone of about $1.75 per ton of ore delivered to the flotation plant, and that it would be necessary to provide some more equipment to raise the capacity of the plant to what it was with the old operating method with low oil. The silver loss is also somewhat greater. With the market price of spelter at 9½ cents the decrease of profit on one year's tonnage of 580000 would be $1,015,000.

FORMULA ADOPTED FOR PURPOSE OF COMPARISON.

APPENDIX "A"—

Conditions of Sale of Zinc Concentrates Taken for the Sake of Making Comparison of the Financial Results of the Period of Working with Excess Oil with Those of 1916:

Assume Market Quotation for Spelter at East St. Louis.....$9.50 per 100 lbs.
(Being below the average for the period in question.)

For One Ton of Concentrate of 45% Zinc.....$21.00
(Being the usual contract price.)

For each one dollar of the market quotation above five dollars ($5.00) add six dollars ($6.00) per ton of concentrate.

For each unit of zinc in the concentrate above forty-five per cent (45%) add ninety cents (90c) per ton of concentrate.

Allowance for freight, loading, and moisture, per dry ton of concentrate.....$8.00

EXAMPLE—January 1916.

VALUE OF ONE DRY TON OF CONCENTRATE.

Base price for 45% grade			$21.00
Bonus for increase of grades: Grade	54.59		
Basis	45.00		
Increase	9.59	@ $0.90	8.63
Bonus for increase in market price: Market price	9.50		
Basis	5.00		
	4.50	@ $6	27.00
			$56.63
Less freight, loading and moisture			8.00
			$48.63

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 274.

Estimate of increased revenue to Butte & Superior Copper Co. had it followed wet concentration with flotation during period of milling operations at Basin, Montana, January 1st, 1910, to April 30, 1912:

1910			
Dry tons milled at Basin	94,085	Assay value	20.2% Zn
Conc. produced—tons	22,157	Assay value	47.7% Zn
1911			
Dry tons milled at Basin	148,542	Assay value	20.3% Zn
Conc. produced—tons	34,464	Assay value	49.1% Zn
1912			
Jan. to April, inclusive, estimated tons milled	50,000	Estimated Assay value	20.0% Zn
Estimated production, 57% recovery, 49% grade concentrate	11,630	tons conc.	
Total tons treated at Basin			
Jan. 1st, 1910, to Apr. 30, 1912			292,627 tons
Zinc content			59,159 tons
Total tons zinc conc. made at Basin			68,251 tons
Zinc content			33,189 tons
Total recovery at Basin in form of zinc conc.			56.1%

Net Smelter Returns		
1910—Net value per ton conc.	$19.67	$ 496,099.49
1911—Net value per ton conc.	$24.85	875,369.73
1912—Estimated ditto	$26.00	302,380.00
		$1,673,849.22

Operating costs—same period			
1910—Mining & Dev.	$3.15 per ton	$295,367.75	
Ore Transp.	.55 per ton	51,746.75	
Milling	1.75 per ton	164,648.75	
1911—Mining & Dev.	$3.06 per ton	454,338.52	
Ore Transp.	.26 per ton	38,620.92	
Milling	1.62 per ton	240,638.04	
1912—Estimated:			
Mining & Dev.	$3.06 per ton	153,000.00	
Ore Transp.	.26 per ton	13,000.00	
Milling	1.62 per ton	81,000.00	$1,493,560.73
Operating profit at Basin			$ 180,288.49

Plaintiffs' Exhibit No. 274

Total ore treated at Basin			292,627 tons
Zinc conc. produced	68,251 tons		
Lead conc. produced	752		69,003 tons
Total tons tailings to discard			223,624 tons
Containing			25,780 tons of zinc
Calculated % of zinc in discarded tailings			11.34% Zn.

Assume that all discarded tailings were re-ground and treated by flotation at an extra operating cost of 75 cents per ton with results as follows:

Concentrate	55% Zn	24 Oz Ag	.04 Au
Tailings	1.5% Zn		
Recovery	89.25%		

Zinc concentrate produced by flotation from discarded tailings—41,834 tons, containing 23,008.65 tons of zinc.

Value of 41,834 tons zinc concentrate, assumed to have been produced from Basin mill discarded tailings—

55% Zn at average market price		5.67 cents	
24 Oz. Ag. average market price		54 cents	
.04 Oz. Au. @ $19.00			equals
Value of zinc		$37.19	
Net value Ag. & Au.		3.88	
		$41.07	
Less freight	$7.91		
Loading at Basin	.09		
Mesh penalty	.50	8.50	
Net value per ton		$32.57	
41.834 tons @ $32.57			$1,362,533.38
Less estimated cost of flotation treatment, 223,624 tons @ 75c			167,718.00
Estimated excess operating profit			$1,194,815.38
Deduct for cost of construction of 500 ton flotation plant			90,000.00
Increase in net profit			$1,104,815.38

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

MINERALS SEPARATION LIMITED ET AL VS. BUTTE AND SUPERIOR MINING COMPANY

Comparison of results at Timber Butte and Butte and Superior Mills for 1st quarter of 1917.

C

Mill	Material	Tons	Tons per cent of feed	Assay Zinc %	Tons of Zn. in products of 100 tons of flotation feed	% Recovery of zinc in flotation products by flotation feed and conc.	% Recovery of zinc in flotation products by flotation conc. and tailing
Timber Butte Mill	Flotation feed	37992.8	100.000	14.295	14.295	100.00	100.00
	Flotation concentrate	9742.6	25.643	54.474	13.969	97.72	96.34
	Flotation tails (given)	28250.2	74.357	0.714	0.531	3.71	3.64
	Flotation tails (calculated)	28250.2	74.357	0.438	0.326	2.28	.....
Butte & Superior Mill	Flotation feed	136469	100.000	12.793	12.793	100.00	100.00
	Flotation concentrate	30724	22.514	47.22[illegible]	10.632	83.11	86.23
	Flotation tails (given)	105745	77.486	2.192	1.698	13.27	13.77
	Flotation tails (calculated)	105745	77.486	2.789	2.161	16.89	.....

Filed May 18, 1917 GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

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Plaintiffs' Exhibit No. 276.

BOTTLE OF OIL

(Physical Exhibit)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 277.

3 REELS FILMS.

(Physical Exhibit)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5446

Plaintiff's Exhibit No. 278.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

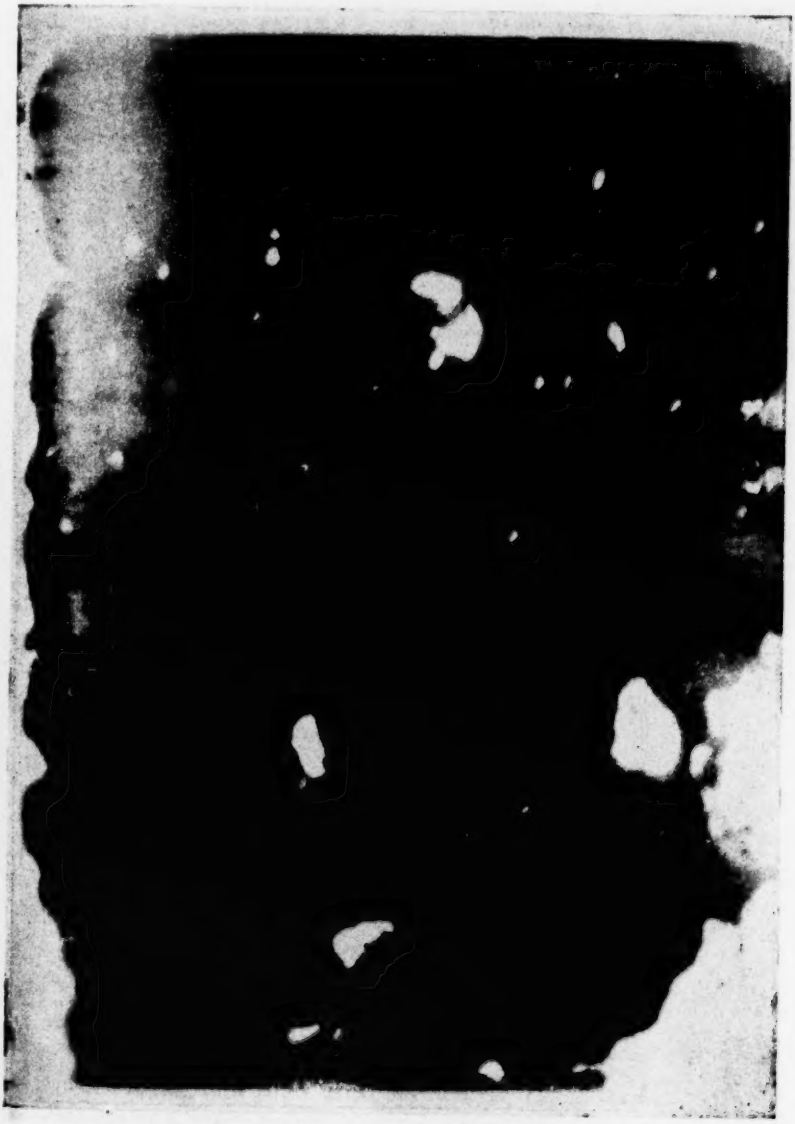
194—Rec.

Plaintiff's Exhibit No. 279.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5448

Plaintiff's Exhibit No. 280.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 281.

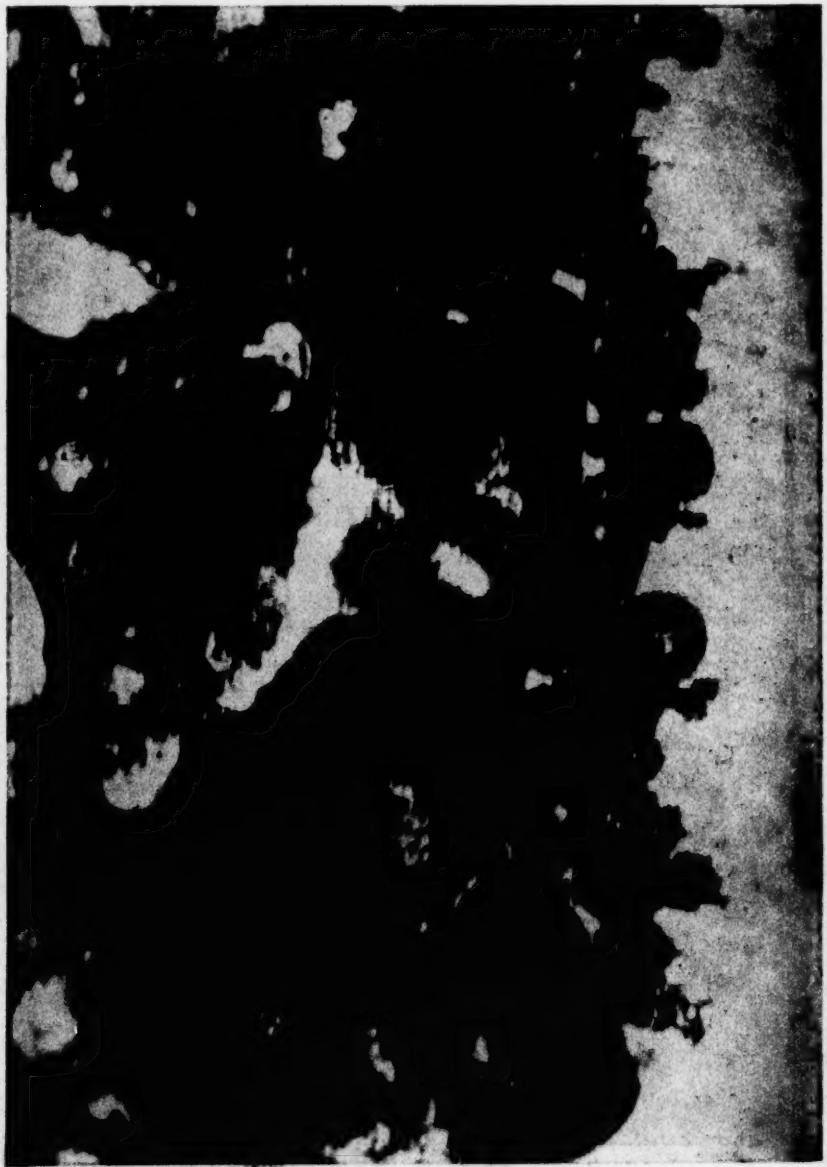
Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5450

Plaintiff's Exhibit No. 282.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 283.



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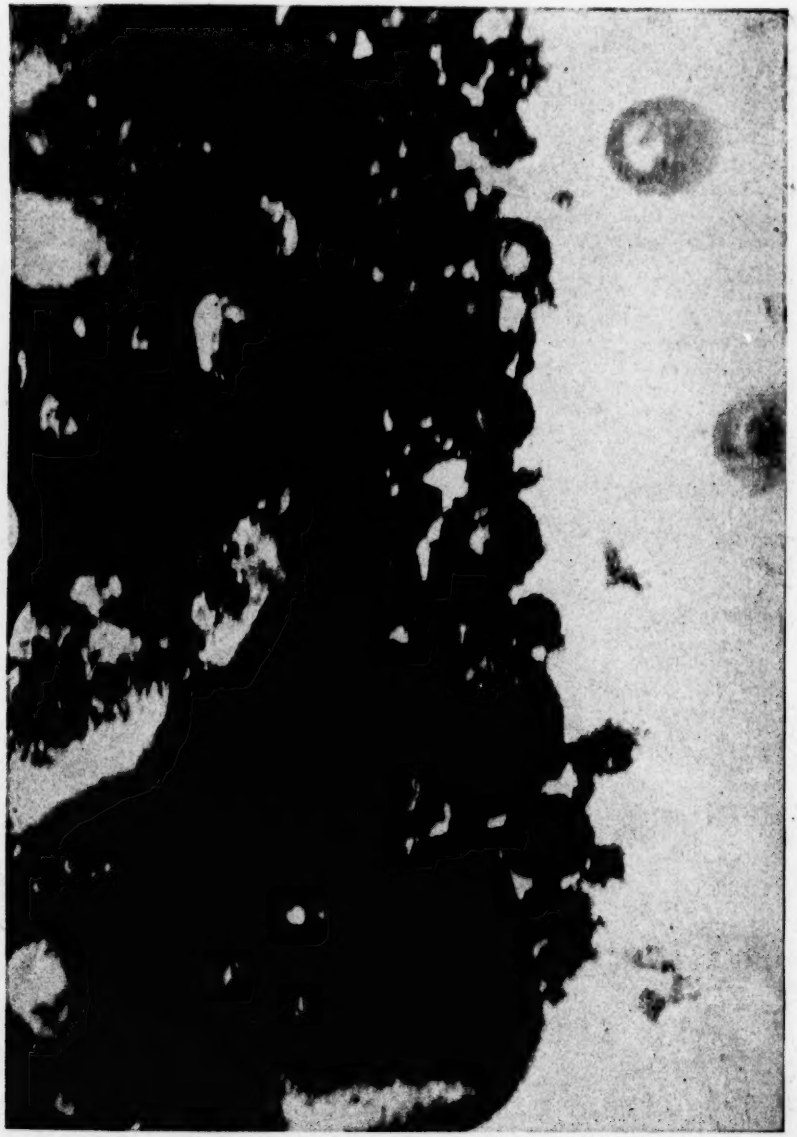
5452

Plaintiff's Exhibit No. 284.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 285.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5455-56

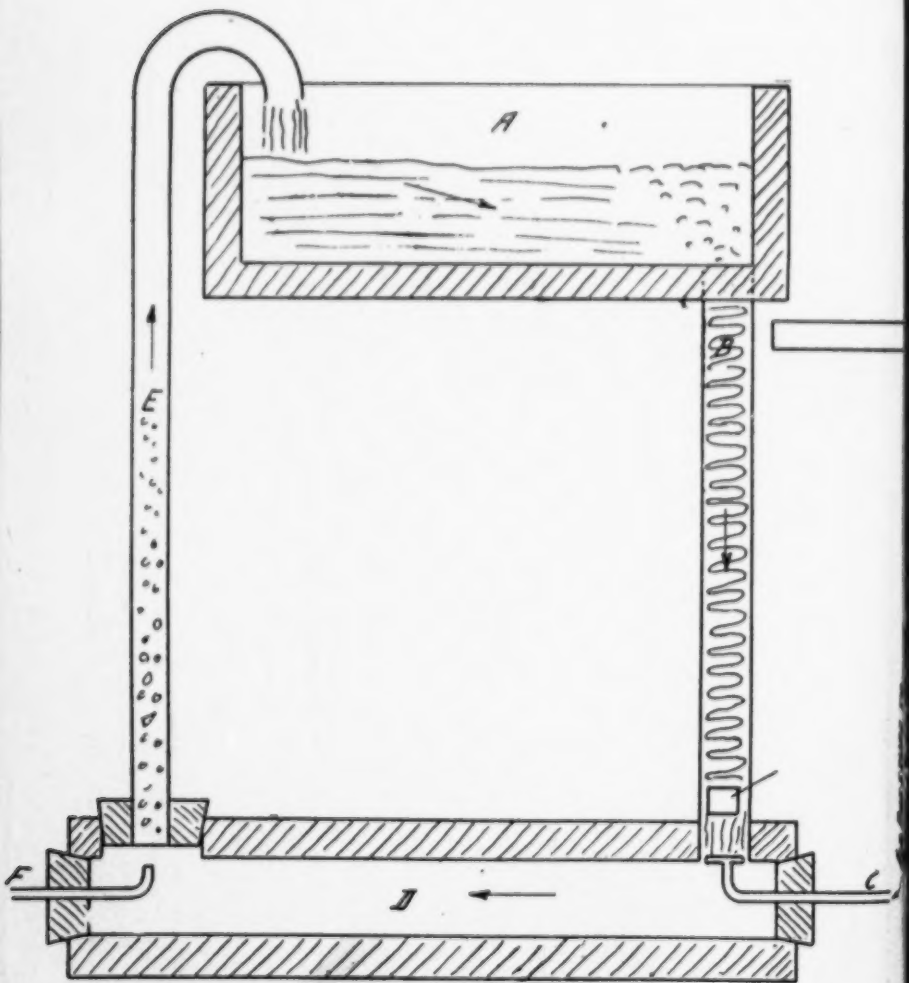
Plaintiff's Exhibit No. 286.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

195—Rec.

5457

PLAINTIFF'S EXHIBIT NO 287—W. M. G.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5458 Plaintiff's Exhibit No. 288.

(A.)

Agreement of July 8, 1913, Between Minerals Separation, Limited, and Minerals Separation American Syndicate (1913), Limited.

(Companies' Registration Office 29 Mar., 1916.)

129,802/33. Registered, 95416*f*, Aug., 1913.

An agreement made the eighth day of July, one thousand nine hundred and thirteen, between Minerals Separation, Limited, having its registered office at 62 London Wall, in the city of London (hereinafter called the Company), of the one part, and Minerals Separation American Syndicate (1913), Limited, having its registered office at 62 London Wall aforesaid (hereinafter called the Syndicate), of the other part.

Whereas the Syndicate was incorporated on the twenty-seventh day of June One thousand nine hundred and thirteen under the Companies (Consolidation) Act 1908 with a nominal capital of Two hundred and fifty thousand pounds divided into One hundred and twenty-five thousand A shares of One pound each and Two
5459 hundred and fifty thousand B shares of Ten shillings each; and whereas by Clause 2 of the Articles of Association of the Syndicate it is provided that the Syndicate shall enter into the Agreement therein referred to being this Agreement now it is hereby agreed as follows:

1. The Company shall sell and the Syndicate shall purchase.

First. The Letters Patent and rights mentioned in the Schedule hereto but subject to certain Licenses granted by the Company the dates of which and the names of the Licensees mentioned therein are as follows:

(A) Twenty fifth June One thousand nine hundred and twelve The Cuba Copper Company.

(B) Nineteenth November One thousand nine hundred and twelve Britannia Mining and Smelting Company Limited as modified by letter dated Seventeenth December One thousand nine hundred and twelve from the Company to the said Britannia Mining and Smelting Company Limited.

(C) Sixteenth January One thousand nine hundred and thirteen The Silverton Mines Limited and Robert Insinger.

(D) Twenty seventh February One thousand nine hundred and thirteen The Ducktown Sulphur & Copper and Iron Company Limited.

(E) Tenth April One thousand nine hundred and thirteen. The Inspiration Consolidated Copper Company.

5460 (F) Seventh May One thousand nine hundred and thirteen. The Elm Orlu Mining Company.

(G) Seventh May One thousand nine hundred and thirteen. The Colusa Parrot Mining and Smelting Company.

(H) Thirteenth May One thousand nine hundred and thirteen William B. McDonald and Louis S. Nobel.

Secondly. The benefit and rights of the Company of and under the said licenses and of any other licenses that may be granted prior to the completion of the purchase and Thirdly: The exclusive right so far as the Company can confer the same to apply for and obtain in the Republic of Cuba and the Philippine Islands Patents in connection with any of the Inventions comprised in the Letters Patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gaseous flotation or other surface Tension phenomena.

2. Part of the consideration for the said sale shall be the sum of Ninety three thousand seven hundred and fifty pounds which shall be paid and satisfied by the allotment to the Company or its nominee or nominees of One hundred and eighty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate.

3. As the residue of the consideration for the said sale the Syndicate shall indemnify the Company against all liability and obligations of the Company under or in respect of any of the licenses

5461 granted by them and particulars of which are set out in Clause 1 hereof and shall also indemnify the Company against all liability and obligations of the Company under or in respect of all costs and charges already or hereafter to be incurred by the Company in connection with applying for and taking out patents in the said Republic of Cuba and the Syndicate shall further indemnify the Company against the liabilities of the Company under a letter dated second day of March One thousand nine hundred and ten from the Company to One James M. Hyde and against all sums which the Company may have been ordered and may be ordered to pay to the said James M. Hyde in connection with certain litigation pending between the Company and the said James M. Hyde in the United States of America and against the costs, charges and expenses of the Company in connection with the said litigation and the Syndicate shall at once repay to the Company all disbursements already made by the Company on account thereof or in connection therewith. The Syndicate shall be entitled to receive all damages and any other profits or benefits which may be derived from or in connection with the said litigation.

The purchase shall be completed on or before the tenth day of October One thousand nine hundred and thirteen at the registered office of the Syndicate when One hundred and thirty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate part of the said One hundred and eighty

5462 seven thousand five hundred fully paid B shares shall be allotted to the Company or its nominees and the Company and all other necessary parties if any shall at the expense of the Syndicate, execute and do all assurances and things for vesting in the Syndicate or as it shall direct the premises mentioned in the Schedule hereto and giving to the Syndicate the full benefit of this Agreement as shall be reasonably required. As to fifty thousand fully paid B shares of Ten shillings each in the Capital of the Syndicate the balance of the said One hundred and eighty seven thousand five hundred B shares the same shall be allotted to the Company or its nominees at the rate of Two shares for every one "A" share of One pound each in the initial capital of the Syndicate part of the last Twenty five thousand A shares in such capital which shall be hereafter allotted that is to say when one of such "A" shares shall be allotted there shall be allotted to the Company or its nominees Two of such fully paid "B" shares. No new shares in the Capital of the Syndicate shall be created or issued until the whole of the shares in the initial capital of the Syndicate shall have been allotted.

5. The Company shall with all convenient speed and at cost price communicate to the Syndicate or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the Letters Patent mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating pulverulent materials by oil selection, gaseous flotation or other surface tension phenomena and shall give

5463 to the Syndicate or its assigns as full information as may be possible as to the exact mode of working and using such improvements, additions and new discoveries but any plans, drawings and models required by the Syndicate or its assigns in connection therewith shall be furnished to the Syndicate or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Syndicate or its assigns execute and do all such documents and things as may be requisite for enabling the Syndicate or its assigns to obtain letters patent in the United States of America and the Dominion of Canada, the Republic of Mexico, the Republic of Cuba and the Philippine Islands for such improvements, additions and new discoveries.

6. The Syndicate shall with all convenient speed and at cost price communicate to the Company or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the letters patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gaseous flotation or other surface tension phenomena and shall give to the Company or its assigns as full information as possible as to the exact mode of working and using such improvements additions and new discoveries but any plans

5464 drawings and models required by the Company or its assigns in connection therewith shall be furnished to the Company or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Company or its assigns execute and do all such documents and things as may be requisite for enabling the company or its assigns to obtain Letters Patent elsewhere than in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba and the Philippine Islands for such improvements additions and new discoveries.

7. The Syndicate shall not dispute the validity of any of the patents and patent rights for the time being belonging to the Company nor in any manner support any litigation against the Company. The Company and the Syndicate shall mutually assist each other as far as possible (except financially) in all litigation against infringers or alleged infringers of the said Letters Patent or in respect of Letters Patent which may from time to time be held by or belong to either of them. The Company and the Syndicate shall also mutually assist each other in negotiating for the acquisition upon the best possible terms of new inventions and discoveries and patents for the same or improvements thereof by third parties which it may be considered desirable either to acquire or control in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba or the Philippine Islands or any other part of the world.

8. The Syndicate shall pay all the costs charges and ex-
5465 penses of and incident to the preparation and execution of this agreement and of the Syndicate's memorandum and Articles of Association and shall also pay all stamps fees and legal and other expenses incident to the formation and registration of the Syndicate.

9. The Syndicate shall cause this Agreement to be duly filed with the Registrar of Companies pursuant to Section 88 of the Companies (Consolidated) Act 1908 and also in the case of shares allotted to nominees shall cause a sufficient contract to be filed constituting the title of such nominees.

In witness whereof the Companies parties hereto have caused their respective common seals to be hereto affixed the day and year first above written.

The Schedule Above Referred to.

Part 1.

1. The benefit of the following Letters Patent granted in respect of the United States of America.

No.	Date.	Name.
777,273.	13/12/04.	Cattermole.
763,259.	21/ 6/04.	"
763,260.	21/ 6/04.	"

No.	Date.	Name.
809,959.	16/ 1/06.	E. B. Kirby.
838,626.	18/12/06.	"
763,749.	28/ 6/04.	Goyder & Laughton.
784,999.	14/ 3/05.	"
5466		
864,597.	27/ 8/07.	De Bavay.
912,783.	27/ 8/07.	"
776,145.	29/11/04.	C. V. Potter.
1,045,970.	3/12/12.	Potters S. O. T. Co.
Ser.		
683,005.	11/ 3/12.	L. Bradford.
793,808.	4/ 7/05.	Sulman & Picard.
788,247.	25/ 4/05.	Cattermole, Sulman & Picard.
777,274.	13/12/04.	"
879,985.	25/ 2/08.	H. L. Sulman.
835,120.	6/11/06.	Sulman, Picard & Ballot.
835,143.	6/11/06.	H. L. Sulman.
835,479.	6/11/06.	Sulman, Picard & Ballot.
902,018.	27/10/08.	H. L. Sulman & E. A. Sulman.
962,678.	28/ 6/10.	Greenway, Sulman & Higgins.
953,746.	5/ 4/10.	T. J. Hoover.
Ser.		
587,621.	17/10/10.	Greenway & Lavers.
Ser.		
647,239.	1/ 9/11.	Nutter & Lavers.
Ser.		
636,245.	30/ 6/11.	H. H. Greenway.
Ser.		
665,900.	4/12/11.	E. H. Nutter.
Ser.		
651,188.	25/ 9/11.	Nutter & Hoover.
5467		
Ser.		
712,309.	30/ 7/12.	Chapman & Tucker.
Ser.		
723,327.	1/10/12.	J. Hebbard.
738,586.	26/12/12.	Chapman & Tucker.
Ser.		
732,386.	19/12/11.	A. C. Howard.
955,012.	12/ 5/10.	H. L. Sulman.
979,857.	27/12/10.	T. J. Hoover, Broadbridge & Howard.
Ser.		
768,374.	17/ 4/13.	Greenway & Lowry.
Ser.		
766,250.	8/ 5/13.	Chapman.

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such Patents as aforesaid.

Part 2.

1. The benefit of the following Letters Patent granted in respect of the Dominion of Canada viz:—

No.	Date.	Name.
87,785.	14/ 6/04.	Cattermole.
87,786.	14/ 6/04.	"
76,621.	8/ 7/02.	C. V. Potter.
121,676.	2/11/09.	Potter S. O. T. Co. (T. J. Greenway.)
169,146.	13/ 3/12.	"
87,700.	7/ 6/04.	Sulman & Picard.
5468		
94,516.	1/ 8/05.	Cattermole, Sulman & Picard.
96,183.	21/11/05.	Sulman, Picard & Ballot.
96,182.	21/11/05.	"
99,743.	26/ 6/06.	"
127,397.	9/ 8/10.	Greenway, Sulman & Higgins.
129,819.	13/12/10.	T. J. Hoover.
134,271.	11/ 7/11.	Greenway & Lavers.
135,089.	22/ 8/11.	Sulman & Picard.
137,404.	19/12/11.	Nutter & Lavers.
142,607.	3/ 9/12.	H. H. Greenway.
Ser. 166,434.	18/11/11.	Nutter & Hoover.
147,431.	22/ 4/13.	Chapman & Tucker.
Ser. 176,341.	17/ 1/13.	J. Hebbard.
Ser. 175,775.	26/12/12.	Chapman & Tucker.
147,432.	22/ 4/13.	A. C. Howard.
94,718.	15/ 8/05.	S. S. & Steele.
129,820.	13/12/10.	T. J. Hoover. Broadbridge & Howard.
Ser. 179,523.	21/ 5/13.	Greenway & Lowry.

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

5469 Part 3.

1. The benefit of the following Letters Patent granted in respect of the Republic of Mexico.

No.	Date.	Name.
3,397.	15/12/03.	Cattermole.
4,268,	12/ 1/05.	De Bavay.
4,267.	12/ 1/05.	"
4,269.	12/ 1/05.	"
3,605.	24/ 3/04.	C. V. Potter.
9,362.	14/ 7/09.	Potter S. O. T. Co.
12,781.	12/ 3/12.	Potter S. O. T. Co.
3,276.	19/10/03.	Sulman & Picard.
3,642.	12/ 4/04.	Cattermole Sulman & Picard.
4,908.	14/ 9/05.	Sulman Picard & Ballot.
5,560.	21/ 4/06.	
4,907.	14/ 9/05.	" "
5,561.	21/ 4/06.	" "
4,622.	27/ 5/05.	S. Steele & Steele.
4,635.	1/ 6/05.	"
5,603.	26/ 4/06.	Sulman Picard & Ballot.
5,602.	26/ 4/06.	"
9,422.	26/ 7/09.	Minerals Separation, Ltd.
9,592.	9/ 9/09.	"
11,087.	19/10/10.	"
11,898.	20/ 7/11.	"
11,943.	6/ 7/11.	"
12,291.	31/10/11.	"
12,050.	11/ 8/11.	"

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12,290.	31/10/11.	Minerals Separation, Ltd.
13,316.	14/ 8/12.	"
13,820.	8/ 1/13.	"
13,749.	17/12/12.	"
13,991.	6/ 3/13.	"
		Broadbridge & Howard.
		Greenway & Lowry.

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

Part 4.

1. The benefit of the following Letters Patent and application for Letters Patent granted in respect of the Republic of Cuba, viz:

No.	Date.	Name.
1,521.	2/ 5/11.	Minerals Separation, Ltd.
1,520.	2/ 5/11.	"

Application for patent filed 26/3/13.

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

The Common seal of Minerals Separation, Ltd., was hereto affixed in the presence of

JOHN BALLOT,
W. W. WEBSTER,
Directors. [SEAL.]
E. WILLIAMS, *Secretary.*

5471 The Common Seal of Minerals Separation American Syndicate (1913) Limited was hereto affixed in the presence of

EMIL BEER,
H. A. KROHM,
Directors. [SEAL.]
E. WILLIAMS, *Secretary.*

A true copy.
GEO. J. SARGENT,
Assistant Registrar of Joint Stock Companies.

(Stamp.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5472 Plaintiff's Exhibit No. 289.

Bill of Sale from Minerals Separation American Syndicate (1913), *Limited, to Minerals Separation North American Corporation.*

Know all men by these presents

That Minerals Separation American Syndicate (1913), Limited, a company incorporated under the Companies Consolidated Act 1908, having its registered office at No. 62 London Wall, in the City of London, England, for and in consideration of five hundred thousand (500,000) shares, without nominal or par value, of the stock of Minerals Separation North American Corporation, a corporation duly organized and existing under the laws of the State of Maryland, whose principal office is in the Continental Building, in the City of Baltimore, in the State of Maryland, of the assumption by said Minerals Separation North American Corporation of all the debts, liabilities and obligations, contractual or otherwise, of said Minerals Separation American Syndicate (1913), Limited, and for other valuable considerations to it moving by said Minerals Separation North American Corporation, the receipt whereof is hereby
5473 acknowledged, has bargained, sold, assigned, transferred and set over, and by these presents does bargain, sell, assign, transfer and set over to said Minerals Separation North

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American Corporation, all the patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto),

processes, licenses, inventions, applications for patents and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations now owned by said Minerals Separation American Syndicate (1913), Limited, and all the right, title and interest in and to patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto), processes, licenses, inventions and applications for patents, and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations to which said Minerals Separation American Syndicate (1913), Limited, is now or to which it shall hereafter become entitled by virtue of any existing agreements or otherwise, and all the cash on hand and in banks, whether in the Kingdom of Great Britain, the United States of America, or elsewhere, promissory notes, bills of exchange, drafts, outstanding accounts, bills receivable, moneys due and to grow due, royalties due and to grow due, claims and demands and things in action, office furniture and fixtures and other chat-
5474 tels, and all the business, property and assets of Minerals Separation American Syndicate, (1913), Limited, of every sort, nature or description, including the good will of its business, as a going concern;

To have and to hold the same unto Minerals Separation North American Corporation, its successors and assigns, to its and their own use absolutely and forever; subject, however, to the payments, discharges and performances as the case may be, of all the debts, liabilities and obligations, contractual or otherwise, of Minerals Separation American Syndicate (1913) Limited.

Page 3.

And for the considerations aforesaid, said Minerals Separation American Syndicate (1913), Limited, covenants and agrees with said Minerals Separation North American Corporation and its successors and with all and every person or persons whomsoever lawfully or equitably deriving any estate, right, title or interest of, in or to the property hereby sold, assigned and transferred, that it shall and will at any time or from time to time hereafter, upon request of said Minerals Separation North American Corporation, its successors or assigns, but at the cost and expense of said Minerals Separation North American Corporation, its successors or assigns, make, do, execute, acknowledge or deliver, or cause to be made, done, executed, acknowledged or delivered, all and every such further and
5475 other lawful acts, deeds, bills of sale, transfers, assignments and assurances in the law, whether in the United States of America, Kingdom of Great Britain or any other country, for the better and more effectual vesting and confirming the property hereby bargained, sold, assigned, transferred and set over, or so intended to be, in and to said Minerals Separation North American Corporation, its successors and assigns forever, as by said Minerals Separation North American Corporation, its successors or assigns, or its or their counsel learned in the law shall be reasonably advised or required.

Annexed hereto, marked "A" and made part hereof, is a partial

list of the patents and applications either owned by the Minerals Separation American Syndicate, (1913), Limited, the vendor corporation, or in or to which it has any right, title or interest, and which is part of the property hereby transferred or intended so to be.

Annexed hereto and made part hereof and marked "B" is a partial list of the licenses granted in respect of the

Page 4.

patents either owned by the Minerals Separation American Syndicate (1913), Limited, the vendor corporation, or in which patents it has any right, title or interest.

In witness whereof, Minerals Separation American Syndicate (1913), Limited, has caused its name to be hereto affixed by
5476 John Ballot, its duly constituted Attorney in Fact, under and by virtue of a Power of Attorney dated October 11, 1916.

MINERALS SEPARATION AMERICAN SYNDICATE (1913), LIMITED,
By JOHN BALLOTT,
Its Attorney in Fact.

STATE OF MARYLAND,
City of Baltimore, ss:

On December 7th, 1916, before me personally came John Ballot, the Attorney-in-Fact of Minerals Separation American Syndicate (1913), Limited, a Company organized under the laws of Great Britain, to me personally known and known to me to be the individual described in and who as such Attorney executed the within instrument and acknowledged that he executed the same as the act and deed of Minerals Separation American Syndicate (1913), Limited, therein described by virtue of a Power of Attorney duly executed by said Minerals Separation American Syndicate (1913) Limited, bearing date October 11, 1916, which Power of Attorney was exhibited to me.

[SEAL.] EMMA L. BURKE,
Notary Public.

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Patents Granted in Respect of the United States of America.

No.	
763,259.	Classifier.
763,260.	Separator and Classifier.
763,749.	Separation of Minerals.
776,145.	Potter.
777,273.	Separator.
777,274.	Soap and Granulation.

No.

784,999. Separating and Concentrating.
788,247. Soap and Flotation.
793,808. Air Bubbles.
809,959. Kirby Separator.
835,120. Oleic Acid Froth.
835,143. Boiling.
835,479. Super-Aerator.
838,626. Kirby Separator.
864,597. De Bavay.
879,985. Table Flotation.
902,018. Buddle.
912,783. De Bavay.
953,746. Froth Apparatus with Baffle.
955,012. Alcohol.
962,678. Solution.
979,857. Frothing Apparatus Agitator as Pump.
1,045,970. T. J. Greenway.
1,064,209. Staggered Spitz.

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1,064,723. Essential Oils.
1,067,485. Fractional Flotation.
1,071,784. Controlling the Flow of thick pulpy material.
1,079,107. Sodium Bisulphate.
1,084,196. Open Spitz.
1,084,210. Agitator.
1,093,463. Froth Trap.
1,099,699. Copper Ores without Acid.
1,101,506. Bradford.
1,102,873. Doctored Water.
1,102,738. Bi-chromate.

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Patents Granted in Respect of the United States of America.

No.

1,102,874. Modifying during Grinding.
1,142,821. Alkali & Bi-chromate.
1,142,822. Littleford.
1,155,815. Sub-Aerator.
1,155,816. Sub-Aeration Apparatus.
1,155,836. Owen's Apparatus.
1,155,861. Bubble Separation without Oil.
1,170,665. Acid Sludge.
1,170,637. Sulphuric Acid Compounds.
1,157,176. Owens Permanganate.

5479 Applications.

Ser. No.

262,890. Air Flotation without Oil (abandoned).

No.

766,346. Metallic Sulphides.
793,270. Steam Spray.
800,966. Ferric Chloride.
808,986. Copper Precipitant.
824,765. Alkaline Float.
831,939. Flotation Process by Sub-Aeration.
835,812. Owen's Selective Flotation.
843,304. Sodium Carbonate.
845,086. Copper Precipitant.

Ser. No.

858,737. Insufficient Acid.

No.

858,738. Insufficient Frothing Agent.
863,097. Classifying.
863,098. Sizing.
864,230. Argol.
872,470. Aqueous Extract of Oil.
14,015. Electrical Relations (1).
20,815. Hebbard's Coke.
27,098. Concentrated Alkali.
34,644. Electrical Relations (2).
37,350. Seale & Shellshear.
39,927. Metallic Sulphides.
40,847. Bleaching Powder.
766,346. Metallic Sulphides.

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Applications.

Ser. No. 74,921. Martin's Inventions.
" 74,922. Martin's Inventions.
" 91,873. Horizontal Agitator.
" 94,339. Caustic Alkalis.
" 105,916.
Divisional from—
Ser. No. 14,015
Ser. No. 108,208 } Electrical Relations (1).
Ser. No. 108,209
Divisionals from—
Ser. No. 766,346. Metallic Sulphides.
Divisional from—
Ser. No. 824,765. Alkaline Float.

Patents Granted in Respect of the Dominion of Canada.

No.

76,621. Potter.
87,700. Air Bubbles.
87,785. Separator.
87,786. Classifier.
94,332. Di-electric Separator (Abandoned).

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94,516. Soap.
94,718. Concentrating Table.
86,182. Oleic Acid Froth.
96,183. Air Flotation.
99,743. Super-Aerator.
121,676. Potter's S. O. T. Limited (Abandoned).
127,397. Solution.
129,819. Froth Apparatus with Baffle.
129,820. Agitator as Pump.
134,271. Essential Oils.
135,089. Livening Oxidised Ores.
137,404. Fractional Flotation.
142,607. Copper Ores without Acid.

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Patents Granted in Respect of the Dominion of Canada.

No.

147,431. Sodium Bisulphate.
147,432. Agitator.
148,275. Froth Trap.
151,479. Open Spitz.
151,480. Bi-chromate.
151,619. Bradford.
151,810. Steam Spray.
157,488. Modifying during Grinding.
157,603. Metallic Sulphides.
157,604. Copper Precipitant.
160,692. Staggered Spitz.

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160,693. Ferric Chloride.
160,694. Sub-Aerator.
160,846. Alkali & Bi-chromate.
160,847. Sodium Carbonate.
160,848. Insufficient Frothing Agent.
160,849. Insufficient Acid.
160,850. Alkaline Float.
163,608. Doctored Water.

No.
163,707. Hebbard's Coke.
164,587. Bubble Separation Without Oil.
165,390. Bleaching Powder.
163,936. Owen's Selective Flotation.
166,415. Electrical Relations (1).
167,474. Sulphuric Acid Compounds.
167,603. Acid Sludge.
167,475. Concentrated Alkali.
167,476. Scale & Shellshear.
160,937. Owen's Permanganate.
151,810. Steam Spray.
157,604. Copper Precipitant.
163,936. Owen's Selective Flotation.

Applications.

Ser. No. 202,962. Caustic Alkalis.
" " 204,309. Soap Froth.

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Patents Granted in Respect of the Republic of Mexico.

No.
3,276. Air Bubbles.
3,397. Separator & Classifier.
3,605. Potter.
3,642. Soap.
4,267. Amalgamation Agreement.
4,268. " "
4,269. " "
4,622. Di-Electric Separator.
4,635. Concentrating Table.
Re-issue {4,907. Oleic Acid Froth.
{5,561. "
Re-issue {4,908. Air Flotation.
{5,560. "
5,602. Super-Aerator.
5,603. Cylinder & Selective Flotation.
9,362. Potter's S. O. T., Ltd.
9,422. Solution.
9,592. Froth Apparatus with Baffle.
11,087. Essential Oils.
11,943. Livening Oxidised Ores.
11,989. Frothing apparatus Agitator as Pump.
12,050. Copper Ores without Acid.
12,290. Froth Trap.
12,291. Fractional Flotation.
5484 12,781. Potter's S. O. T., Ltd.
13,316. Sodium Bisulphate.

No.
13,749. Howard's Agitator.
13,820. Doctored Water.
13,991. Staggered Spitz.
14,196. Bi-chromate.
14,208. Metallic Sulphides.
14,344. Open Spitz.
14,537. Modifying during grinding.
14,696. Steam Spray.
14,749. Ferric Chloride.
14,833. Sub-Aerator.
14,862. Copper Precipitant.
14,980. Owen's Selective Flotation.

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Patents Granted in Respect of the Republic of Mexico.

No.
15,030. Alkaline Float.
15,160. Alkaline & Bi-chromate.
15,223. Insufficient Acid.
15,277. Insufficient Frothing Agent.
15,292. Sodium Carbonate.
15,513. Bubble Separation without Oil.
15,523. Sulphuric Acid Compounds.
15,524. Acid Sludge.
15,549 bis. Electrical Relations.
15,598. Hebbard's Coke.
15,656. Concentrated Alkali.

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15,618. Bleaching Powder.
15,625. Scale & Shellshear.
15,029. Owen's Permanganate.
14,537. Modifying during Grinding.
14,696. Steam Spray.
14,749. Ferric Chloride.
14,833. Sub-Aerator.
14,862. Copper Precipitant.
15,160. Alkali & Bi-chromate.
15,223. Insufficient Acid.
15,549 bis. Electrical Relations (1).
15,656. Concentrated Alkalis.
16,003. Caustic Alkalis.

Patents Granted in Respect of the Republic of Cuba.

No.
1,520. Frothing Apparatus Agitator as Pump.
1,521. Alcohol & Solution.

No.
1,946. Doctored Water.
1,976. Modifying during grinding.
2,116. Copper Precipitant.

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B.

Various Licenses Granted.

Name of licensee.	Date of license.
Cuba Copper Co.	25th June, 1912.
Britannia Mining & Smelting Co.	19th November, 1912.
Silverton Mines	16th January, 1913.
Ducktown Sulphur, Copper & Iron Co.	27th February, 1913.
Inspiration Copper Co.	10th April, 1913.
Colusa Parrot Mining & Smelting Co.	7th May, 1913.
Elm Orlu Mining Co.	7th May, 1913.
Wm. MacDonald & Louis S. Noble	13th May, 1913.
Atlas Mining & Milling Co.	22nd May, 1913.
Consolidated Arizona Smelting Co.	19th September, 1913.
Old Dominion Copper Mining & Smelting Co.	26th September, 1913.
M. W. Atwater	6th February, 1914.
Flint Mines Ltd.	16th February, 1914.
Mountain Copper Co.	11th March, 1914.
Mond Nickel Co., Ltd.	30th April, 1914.
Mineral Recovery Co.	19th May, 1914.
Phelps, Dodge & Co.	11th June, 1914.
Engels Copper Mining Co.	18th June, 1914.
Standard Silver Lead Mining Co.	24th June, 1914.
Cusi Mining Co.	22nd January, 1915.
Anaconda Copper Mining Co.	1st February, 1915.
Weedon Mining Co.	3rd June, 1915.
Arizona Copper Co., Ltd. (Registered in England)	11th June, 1915.
St. Joseph Lead Co.	16th August, 1915.
Doe Run Lead Co.	16th August, 1915.
Utah Leasing Co.	24th August, 1915.
Portland Gold Mining Co.	29th November, 1915.
Chichagoff Mining Co.	29th November, 1915.
Desloge Consolidated Lead Co.	1st January, 1916.
Sociedad Anonima des Metals, Brockmann & Co., Inc.	March, 1916.
Broadwater Mills Co.	14th March, 1916.

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Name of licensee.	Date of license.
Arizona Copper Co. (Regd. Clifton Greenles Co., Arizona)	21st March, 1916.
Greene Cananea Copper Co	12th May, 1916.
Vindicator Consolidated Gold Mining Co	26th June, 1916.
William Kent	1st July, 1916.
Highland Valley Mining & Develop. Co, N. P. L.	10th August, 1916.
Ceylon Co.	15th August, 1916.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

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Plaintiff's Exhibit 290.

Tons of Flot. Hds. Cu Assay lbs. Cu in Heading
9794 × .0777 × 2000 = 1,521,988

Tons of Flot. Conc. lbs Cu in Conc.
2884 × .2603 × 2000 = 1,501,410

$\frac{1,501,410}{1,521,988} \times 100 = 98.65$

Recovery expressed in % = 98.65

9794 − 2884 = 6910 Tons of Tailing

1,521,988 − 1,501,410 = 20,578 lbs. Cu in Tails

20,578 ÷ 6910 ÷ 20 = .149 % Cu in Tails

20,578 ÷ 9794 = 2.10 lbs. of Cu in Tailing per ton of Heading

2.1 lbs. of Cu at

Filed August 23, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5489 Plaintiff's Exhibit No. 291.

Date: June 24th, 1914.
Parties: Standard Silver-Lead Mining Company, a Washington State Corporation, with place of business at Spokane, Wash.
Mines and Mills at Silverton in the Province of British Columbia, Canada.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates produced One and 25/100 ($1.25) dollars per ton of two thousand (2,000) pounds of zinc concentrates net dry weight; such royalty to be payable for the entire period during wrich concentrates are produced. (Balance the same as in printed form.)

Payments: London.
Staff Members: One at £60 per month.
Contract: England.

Signatories.

STANDARD SILVER-LEAD MINING CO.,
By W. J. C. WANIFUID, *As Its President.*

Attest:
CHARLES HUSSEY,
As Its Secretary.

For Minerals Separation, Ltd.:
JOHN BALLOT,
T. HERBERT CURLE,
Directors.

A. O. WILLIAMS, *Secretary.*

English acknowledgement: August 28th, 1914.
American acknowledgement: July 7th, 1914.
(New Form.)

5490 *Abstract.*

Date: February —, 1914.
Parties: The Flint Mines Limited, a New York corporation, having office at 43 Wall Street, New York, with Mines and Mills situated in the Owyhee County in the State of Idaho.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty at the rate of 2½% (two and one half per cent) of the value of the Silver, less five

ounces, and 2½% (two and one half per cent) of the value of any Antimony paid for less eight units and 25 (twenty-five) cents per ounce of saleable gold contained in the (balance of clause as in printed form.)

Payments: London or New York.
Staff Members: One at £60 per month.
Contract: New York Contract.

Signatories.

THE FLINT MINES, LIMITED,
By HUGH MORGAN, JR., *Secretary.*

Attest:
HUGH MORGAN, JR., *Secy.*

For Minerals Separation, Ltd.:
JOHN BALLOT,
H. A. KROHN,
Directors.

A. O. WILLIAMS, *Secretary.*

English acknowledgement: February 16th, 1914.
American acknowledgement: March 3rd, 1914.
(New Form.)

5491 *Abstract.*

Date: May 19th, 1914.
Minerals Recovery Company a Missouri corporation, having its place of business at Joplin, Missouri, with Mines and Mills located at Joplin, Missouri.
License to treat slime and sand tailings of the Prescilla Mine of Underwriters' Land Company, Joplin Missouri.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates produced from said tailings, as follows: One Dollar and Twenty-five Cents ($1.25) for each ton of two thousand (2,000) pounds dry weight of zinc concentrates: such royalty to be payable for the entire period during which concentrates are produced from said tailings * * * by the use, etc., as in written form (Balance same).

Payment: London;
Staff Members: One at salary of £60 per month.
Contract: To be construed as New York contract.

Signatories.

MINERAL RECOVERY CO.,
By GEO. S. THOMAS, *Pres.*
D. I. HAYES.

Attest:
D. I. HAYES.

For Minerals Separation, Limited:
JOHN BALLOT,
W. W. WEBSTER,
Directors.

A. O. WILLIAMS, *Secretary.*

5492 English Acknowledgement, of date May 29, 1914.
American Acknowledgement, of date May 2nd, 1914.
New Form.

Abstract.

Date: June 14th, 1914.
Engles Copper Mining Company, No. 393 Mills Building, San Francisco, California.
Operations in Plumas County, California, known as Engels Mines.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of twelve cents for each short ton (2,000) lbs. (dry weight) of crude ore milled when said ore contains not more than two and one-half per cent. (2½%) of copper; and fifteen cents for each such short ton of crude ore milled when said ore contains more than two and one-half per cent. (2½%) of copper; such royalty to be payable for the entire period during which concentrates are produced from the ore of said mines by the use of any of the said inventions improvements additions and discoveries, (Balance as in printed form).

Payments: London or New York.
Staff Members: One or more at £60 per month.
Contract: To be construed as New York contract.

Signatories.

ENGELS COPPER MINING COMPANY,
By HENRY ENGELS, *Its President.*
ELMER E. GANTON, *Its Treasurer.*

Attest:
LANDON A. BELL, *Secretary.*

5493 For Minerals Separation, Ltd.:
W. W. WEBSTER,
H. A. KROHN,
Directors.

A. O. WILLIAMS, *Secretary.*

English acknowledgement, June 18, 1914.
American acknowledgement, June 3, 1914.
Attached, Letter of June 23rd, 1914. (See copy.)
New Form.

Copy.

London, June 23rd, 1914.

Engels Copper Mining Company, San Francisco, Calif.

DEAR SIRS: Referring to the license agreement between our Company, Minerals Separation, Limited, and you, we hereby consent—

1st. That the closing sentence of paragraph 3 of said license, reading as follows: "The Licensee shall not, without the consent of the Licensors during the continuance of this license, use or employ any improvement, modification, or addition to any of the inventions specified in the Letters Patent within this license, which said improvement, modification or addition is not the property of the Licensors," shall not preclude the Licensee from using at any time during the term of the license any smelting, leaching or other process for extracting ores which is not essentially a flotation process or an oil concentration process and which does not infringe any of the patents under which said license is granted.

5494 2nd. That we hereby guarantee to the Engels Copper Mining Company, that, should we make any change in our basis of computing royalties tending to reduce the same, or make any general royalty reductions, that you shall have the benefit of such reductions in so far as they may apply to the ores produced at your mines;

3rd. It is understood that we will make no objection at any time to your shipping direct and without the payment of any royalty to us such high grade ores as you may desire to ship without treatment by any of our processes.

Very truly yours,

(Sgd.) W. W. WEBSTER,
H. A. KROHN,
Directors.

[SEAL.] A. O. WILLIAMS,
Secretary.

(M. S., Ltd.)

Abstract.

Date: February 6th, 1914.
Maxwell W. Atwater, of Butte, Silver Bow County, Montana.

Dumps and mills at Basin, Jefferson County, Montana.
Location: In or near Basin, Jefferson County, Montana. Known as the zinc Tailings Dumps on the property owned or controlled by the Licensee at Basin, Montana.

Royalty Clause.

The licensee shall pay to the licensors a royalty on the
5495 total mineral product srecovered in all concentrates produced from said tailings dumps as follows: One and 25/100 ($1.25) Dollars per ton of two thousand (2,000) pounds of zinc concentrates net dry weight; such royalties to be payable for the entire period during which concentrates are produced from said tailings dumps, by the use of any of the said inventions improvements additions and discoveries. (Balance as printed in later form.)

Payments: At London or New York.
Staff Member: To be furnished at £60 per month.
Contract: To be construed as New York contract.

Signatories.

JOHN BALLOT,
H. A. KROHN,
Directors.
A. O. WILLIAMS,
Secretary.
M. W. ATWATER.

English acknowledgement of date March 2, 1914.
American acknowledgement of date February 6th, 1914.
New Form.

5496 *Abstract.*

Date: May 13th, 1913.
Parties: Mineral Separation Limited and William B. McDonald of Leadville, Colorado (Box 566) and Louis S. Noble of 932 Equitable Building, Denver, Colorado.
Property: The Page-Harrigan Dumps (estimated fourteen thousand tons) located in Stray Horse Gulch; the Resurrection Dump (estimated thirty thousand tons) located at Little Ellen Hills and the ore now developed (estimated twenty five thousand tons) in Resurrection Mine Leadville, Colorado, and for no other purpose.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty at the rate of two (2) cents per unit for each unit of zinc contained in said concentrates in excess of eight (8) units a unit being twenty (20) pounds in each ton of two thousand (2,000) pounds of dry weight

of concentrates and at the same rate two (2) cents per unit for each such unit of lead contained in said concentrates in excess of eight (8) such units and also two and one half per cenutm (2½%) of the value of all other products contained in said concentrates as paid for by the smelter on concentrates produced by the use of any
5497 of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof, or additions thereto, or any new patents granted in connection therewith.

Payments: New York and London.
Staff Member: $250.00 per month for six months.
Contract: Under the laws of England.

Signatories.

For the Minerals Separation:

JOHN BALLOT,
T. HERBERT CURLE,
Directors.

A. O. WILLIAMS, *Secretary.*

WM. B. McDONALD AND
LOUIS S. NOBLE.

Witnesses:
HAROLD C. HANKINS.
WILLIAM J. WALTON.

Old Form.

Abstract.

Date: February 27th, 1913.
The Ducktown Sulphur Copper and Iron Company Limited, No. 1 Gresham House, Old Broad Street, London.
Property in the State of Tennessee, U. S. A., only.

Royalty Clause:

The Licensee shall pay to the Licensors royalties at the following rates namely:—Six cents per twenty pounds copper in concentrates produced—two and a half per cent value of saleable silver in
5498 concentrates *in concentrates* produced and twenty five cents per ounce of saleable gold of concentrates produced with a minimum in any case of twelve cents per ton of ore treated by and with the use of any of the inventions specified in the said Letters Patent or by or with the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London.
Staff Member: £60 per month, six months.
Contract under laws of England.

Signatories.

For Minerals Separation:

JOHN BALLOT,
FRANCIS L. GIBBS,
Directors.

A. O. WILLIAMS, *Secretary.*

DUCKTOWN SULPHUR COPPER AND IRON COMPANY, LIMITED.
LEWIS S. MORTIMER,
EDWARD DERBY,
Directors.

W. BERNY, *Secretary.*

Old Form.

Abstract.

Date: March 11th, 1914.

Parties: Minerals Separation Limited and The Mountain Copper Company Limited, whose registered office is situated at 3 Lombard Street London, E. C., (hereinafter called "the Licensees") of the other part.

5499 Property situate in Shasta County, California, known as the Iron Mountain Mines, but not elsewhere.

Royalty Clause.

The licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of Twelve cents for each short ton (Two thousand pounds dry weight) of crude ore milled when said ore contains less than two per cent (2%) of copper and fifteen cents for each such short ton of crude ore milled when said ore contains two per cent (2%) ore more of copper; such royalty to be payable for the entire period during which concentrates are produced from the ore of the said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith. (Balance the same as printed form.)

Payments: London or New York.
Staff Members: One at rate of £60 per month.
Contract: English contract.

Signatories.

THE MOUNTAIN COPPER COMPANY, LIMITED.
N. M. MACDONALD,
Director.

A. N. FREUER, *Secretary.*

For Minerals Separation, Ltd.:

JOHN BALLOT,
FRANCIS L. GIBBS,
Directors.

A. O. WILLIAMS, *Secretary.*

(Old Form.)

5500 *Abstract.*

Date: May 22nd, 1913.
Parties: The Atlas Mining & Milling Company, a Colorado corporation, with registered office at Ouray, Colorado.
Operations in State of Colorado, at Atlas Mines.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates or bullion produced from the ore of said mines as follows: Two and one half (2½%) per cent of the value of the silver in said concentrates or bullion as paid for by the smelters or mint; twenty five (25) cents per ounce for all gold contained in said concentrates or bullion; two (2c.) cents per unit for each unit of lead contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; six (6c.) cents per unit for each such unit of copper contained in said concentrates, if paid for by the smelter; two (2c.) cents per unit for each such unit of zinc contained in said concentrates in excess of eight units, if paid for by the smelter; provided, however, that such payment on concentrates or bullion produced shall not be less than twenty five (25c.) cents for each short ton (2000) dry weight, of crude ore produced from said mine such royalty to be payable for the entire period
5501 during which concentrates are produced from the ore of said mines by the use of any of the inventions specified in the said letters patent, by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith, provided, however, that in computing said royalty and minimum all ore of said mines which has not been treated or a part or parts or product or products whereof has or have not been treated by the use of any of said inventions shall be excluded from computation. (Balance as in Printed form.)

Payments: London or New York.
Staff Members: One or more at £50 per month.
Contract: Shall be construed as English Contract.

Signatories.

(Name of Atlas Mining & Milling Company not affixed.)

WM. HORE, JR.,
W. D. SHIPMAN,
Directors.
C. H. WAGNER,
Vice President.

FRED CARROLL, *Secretary.*

For Minerals Separation, Ltd.:

JOHN BALLOT,
FRANCIS L. GIBBS,
Directors.

A. O. WILLIAMS, *Secretary.*

Attached letter in remodification of terms of royalty.

(Old Form.)

5502 (Copy.)

Atlas Mining & Milling Company.

In letter from Mr. Nutter to the Atlas Mining & Milling Co. of February 10th 1915, he states that Mr. Ballot and Dr. Gregory had agreed and were willing to meet the company as far as possible in the matter of a modification of the terms of the royalty arrangement, and proposed to waive as from January 1st, 1915, the minimum rate of 25c. per ton of material treated by the Atlas Co. From that date they will merely pay the unitage royalty on all metal values recovered as per clause 1 of the License, with no fixed minimum per ton of ore treated.

Abstract.

Date: May 7th, 1913.

Colusa-Parrot Mining and Smelting Company, (a Washington Corporation) of Butte, Montana.
The Old dump hereinafter described.
The old dump at the Butte Reduction Works, near Butte, Montana, and for no other purpose.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the total mineral products in all concentrates produced from said tailings as follows: Six cents per unit for each unit of copper contained in said

concentrates, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; and two and one half per cent of the value of all silver and gold, or either silver or
5503 gold in said concentrates as paid for by the smelter; such royalty to be payable for the entire period during which concentrates are produced from the said tailings or products thereof by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.
Staff Member: For six months at £60 per month.
Contract under Laws of England.

Signatories.

For Minerals Separation:

JOHN BALLOT, *Director*

For Colusa-Parrot:

M. C. MESSIAS, *Secretary.*

Ratified by Colusa Parrott Mining & Smelting Company at a special meeting of the Board of Directors, of date May, 29th, 1913.

(Old Form.)

5504 *Abstract.*

Date: May 7th 1913.
The Elm Orlu Mining Company (a Washington corporation) of Butte, Montana.
The State of Montana, property known as the Elm Orlu Mines.
Use in the Butte District, State of Montana.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty on the mineral products recovered in all concentrates produced from the ore of said Mines, as follows:—two cents per unit for each unit of zinc contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates, six cents per unit for each unit of copper contained in said concentrates; two and one-half per cent. of the value of the silver in said concentrates as paid for by the smelter; and twenty five cents per ounce for all gold contained in said concentrates; or, at the option of the Licensee to be exercised within sixty (60) days from the day and year first above written, in place of the royalty as above set forth computed on the total mineral products recovered in all of the concentrates, a royalty at the rate of fifty cents per ton of two thousand pounds dry weight of all crude ore produced from said

mines; such royalty to be payable for the entire period during which concentrates are produced from the ore of said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or addi-
5505 tions thereto, or any new patents granted in connection therewith.

Payments: London or New York.
Staff Members: One or more at £60 per month for six months.
Contract under laws of England.

Signatories.

For Minerals Separation:
JOHN BALLOT,
H. A. KROHN,
Directors.
A. O. WILLIAMS, *Secretary.*

ELM ORLU MINING COMPANY.
(Sd.) By W. A. CLARK,
Vice President.
W. D. MANGAM, *Secretary.*

Contract ratified by special meeting of Board of Directors of the Elm Orlu Mining Company, of date May 29th, 1913.

(Old Form.)

Abstract.

Date: September 19th, 1913.
Consolidated Arizona Smelting Company, New York, N. Y.
Property, at Humboldt, Arizona, known as the Humboldt Smelter, and its Mines in Mayer, Arizona, known as the Blue Bell Mine and De Sota Mine.
Said Property and mines, only.

Royalty Clause.

The Licensee shall pay to the Licensors a royalty at the
5506 rate of Six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs., dry weight) of crude ore milled; and provided further, that for all concentrates produced from old tailings the royalty shall be as

above stated except that the provision for the minimum rate of such payment shall not be applicable; such royalty to be paid for concentrates produced by the use of any inventions specified in said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London or New York.
Staff Member: At £60 per month.
Contract: Under the laws of England.

Signatories.

For Minerals Separation:
JOHN BALLOT,
W. A. KROHN,
Directors.

CONSOLIDATED ARIZONA SMELTING COMPANY.
VICTOR T. AMMONS, *President.*

FRED W. THOMPSON, *Secretary.*

(Old Form.)

5507 *Abstract.*

Date: September 26th, 1913.
Parties: Old Dominion Copper Mining & Smelting Company, with office situate at Boston, Mass.
Operations at Globe, Arizona.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one-half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for (Balance same as in printed form.)

Payments: London or New York.
Staff members: One at £50 per month.
Contract: As made in England.

Signatories.

For Minerals Separation, Ltd.:
JOHN BALLOT,
H. A. KROHN,
Directors.
A. O. WILLIAMS, *Secretary.*

OLD DOMINION COPPER MINING & SMELTING CO.,
CHARLES S. SMITH, *President.*

CHARLES H. ALTMILL, *Secretary.*

(Old Form.)

See attached letters in re cancellation, of date, June 18, 1914, and July 1st, 1914.

5508 Old Dominion Copper Mining & Smelting Co.,
50 Congress Street.

Charles S. Smith, President.
Charles H. Altmiller, Secy. & Treas.

Telephone Main 6552.

Boston, June 18, 1914.

Minerals Separation, "Limited," 62 London Wall, London, E. C., England.

GENTLEMEN: The Old Dominion Copper Mining & Smelting Company, a party to the license agreement between the Minerals Separation, "Limited," (called the Licensors) and the Old Dominion Copper Mining & Smelting Company, (called the Licensees), dated September 26, 1913, hereby notify said Licensors that the Licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours very truly,

CHARLES S. SMITH, *President.*

5509 Copy.

Registered 1st July, 1914.

M. E. P.

J. B.

Messrs. The Old Dominion Copper Mining & Smelting Co., Mr. Charles S. Smith, President, 50 Congress Street, Boston.

GENTLEMEN: I beg to acknowledge receipt of your letter of the 18th June in which you assume to renounce and abandon the license agreement dated the 26th September 1913, between my Company and the Old Dominion Copper Mining and Smelting Co., and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, and I am instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in assuming that you do not intend in the future to use any of my Company's patented inventions.

If you had so intended we agree of course that you are entitled under the License at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been your intention, my Board hereby
5510 notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part.

I remain, Gentlemen,

Yours faithfully,

(Sgd) A. O. WILLIAMS, *Secretary.*

By Order of the Board.

Abstract.

Date: April 10th, 1913.

Inspiration Consolidated Copper Company, 42 Broadway, New York.

Inspiration Mines, State of Arizona, U. S. A.

Treatment of products of said mines in State of Arizona.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty at the rate of twelve cents (12c.) for each short ton (2,000 pounds dry weight) of ore treated on all tonnages up to and including four thousand (4,000) of such tons per day; at the rate of ten cents (10c.) for each such ton of ore treated on all total tonnages of more than four thousand (4,000) and up to and including six thousand (6,000) of such tons per day; and at the rate of nine (9c.) cents for each
5511 such ton of ore treated on all total tonnages of more than six thousand (6,000) of such tons per day; such royalty to be computed as of the average treatment for each day in the period of three months preceding a quarter day and to be paid in lawful money of the United States on all ore treated by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.
Staff Member: One or more to be furnished at £60 per month.

Signatories.

JOHN BALLOT,
FRANCIS L. GIBBS,
Directors.

A. O. WILLIAMS, *Secretary.*

For Inspiration Consolidated Copper Co.:
W. D. THORNTON, *Vice President.*
J. W. ALLEN, *Secretary.*

Contract ratified by resolution of Board of Directors of Inspiration Consolidated Copper Co. of date March 27, 1913.

(Old Form.)

5512 *Abstract.*

Date: September 16th, 1913.
Phelps, Dodge & Company, New York, N. Y.
Burro Mountain Copper Company.
Treatment of products of said mine.

Royalty Clause.

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the

concentrates; two and one-half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for concentrates produced by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.
Staff Member: To be furnished at £50 per month & expenses.

Signatories.

For Minerals Separation, Limited:

JOHN BALLOT,
W. A. KROHN,
Directors.

A. S. WILLIAMS, *Secretary.*

5513 For Phelps, Dodge & Company:

JAMES DOUGLAS,
CLEVELAND H. DODGE,
Directors.

F. T. BULMER,
Asst. Secretary.

(Old Form.)

See copies of attached letters re cancellation of contract.

Copy.

Phelps, Dodge & Co., Incorporated,

99 John Street, Corner Cliff St.

New York, June 11th, 1914.

Minerals Separation, Limited, 62 London Wall, London, E. C., England.

DEAR SIRS: Phelps, Dodge & Co., a party to the license agreement between Minerals Separation Limited (called the Licensors) and Phelps, Dodge & Co. (called the Licensees) dated September 15th, 1913, hereby notify said licensors that the licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours truly,

PHELPS, DODGE & CO.
GERRY NORTMAN, *Secretary.*

G. N. W.

5514 Copy.

Phelps, Dodge & Co.,

99 John Street, New York.

June 11th, 1914.

Messrs. Beer, Sondheimer & Company, 61 Broadway, City.

DEAR SIRS: Herewith we beg to enclose copy of a letter which we are mailing to-day to the Minerals Separation, Limited, 62 London Wall, London, E. C., England.

Yours very truly,

PHELPS, DODGE & CO.

(Sd.) GEORGE NOTMAN, *Secretary.*

Copy of preceding letter attached.

5515 Copy.

Minerals Separation American Syndicate (1913), Ltd.

S. S. Oceanic.

New York, June 12th, 1914.

Messrs. Minerals Separation, Limited, 62 London Wall, E. C.

DEAR SIRS:

Re Messrs. Phelps, Dodge & Company.

Messrs. Beer, Sondheimer & Company to-day received a letter with enclosure, as per copy herewith. I think it will be best simply to acknowledge receipt and say the matter will be submitted to the Board at its next meeting as soon as the Chairman returns to London. I will be in a better position to explain to the Board on my arrival what has been done here, and what should be done in London.

Yours truly,

(Sd.) JOHN BALLOT.

Encl.

Copy.

S. S. Oceanic.

24th June, 1914.

Messrs. Phelps, Dodge & Company, Inc., 99 John Street, Corner Cliff Street, New York, U. S. A.

5516 DEAR SIRS: We have to acknowledge due receipt of your letter of 11th June, received under registered cover, which will be submitted to our Board of Directors at its next meeting, as soon as our Chairman returns to London.

We are, dear sirs,

Yours truly,

(Sgd.) A. O. WILLIAMS, *Secretary.*

Copy.

Registered 1st July, 1914.

S. S. Olympic.

Messrs. Phelps, Dodge & Co., Mr. George Notman, Secretary, 99 John Street, New York, U. S. A.

GENTLEMEN: Referring to our previous letter to you of the 24th ultimo, and in further reply to yours of the 11th ultimo in which you assume to renounce and abandon the license agreement dated the 16th September, 1913, between my Company and Messrs. Phelps, Dodge & Co. and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, I am now instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in assum-
5517 ing that you do not intend, in the future, to use any of my Company's patented inventions.

If you had so intended we agree, of course, that you are entitled under the license at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been your intention, my Board hereby notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part.

I remain, gentlemen,

Yours faithfully,

(Sgd.) A. O. WILLIAMS, *Sec.*

By order of the Board.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5518 Plaintiff's Exhibit No. 292.

Minerals Separation North American Corporation and —— ——.

License.

Henry D. Williams, Attorney and Counselor at Law, 61 Broadway, New York, N. Y.

5519 This Indenture made the — day of ——, 191–, between Minerals Separation, North American Corporation, of 61 Broadway, New York, N. Y., (hereinafter called "the Licensors,"

which designation shall include its successors and assigns where the context so requires or admits) of the one part and —— ——, a corporation organized and existing under the Laws of —— and having an office or place for the transaction of business situate at —— and whose Mines and Mills are at —— (hereafter called "the Licensees") of the other part.

Whereas the Licensors are entitled to or otherwise control or are interested in Letters Patent for certain inventions for the concentration and treatment of ores described in the Schedule hereto, and are entitled to grant licenses thereunder.

And Whereas, the Licensors have agreed to grant to the Licensees a license to concentrate and treat all or any ores or any part thereof and or dumps now existing in accordance with all or any of the inventions, processes and apparatus described and claimed in the said Letters Patent and any Letters Patent for the concentration of ores that are or may become the property of the Licensors (all of
5520 said Letters Patent being hereinafter called "Letters Patent within this License") at the premises of the Licensees situate in —— and known as the — but not elsewhere.

Now this indenture witnesseth that in pursuance of the said Agreement and of the matters aforesaid and in consideration of the royalties hereby reserved and of the covenants on the part of the Licensees hereinafter contained the Licensors hereby grant unto the Licensees full license power and authority to make, use and exercise any or all of the inventions described and claimed in the Letters Patent within this license, at the Licensees' mines or mills aforesaid and any extension thereof in ——, for the purpose of treating all or any of the ores or any part thereof and or dumps now existing, belonging to or controlled by the Licensees won, dug or otherwise produced at the — and to vend the concentrates and other products resulting from the use and exercise of the said inventions during the terms of the Letters Patent within this License or any of
5521 them and any extension thereof subject nevertheless to the following conditions:

And it is hereby agreed as follows:

1. The Licensees shall pay royalties to the Licensors for the use or the right to use processes and appliances embodying any of the inventions described and claimed in the Letters Patent within this license at a rate —.

2. The Licensees shall keep at the counting house or office of their said mines proper books of account and shall enter therein full and complete particulars of all the ores and/or dumps treated including assay values thereof and of the concentrates and tailings produced also including assay values thereof. The said books of account shall at all convenient times be open to the inspection of a chartered or incorporated accountant to be appointed by the Licensors. The Licensees shall quarterly deliver to the Licensors an account in writing showing the quantity, assay and other particulars of the ores and/or dumps treated during each quarter and the quantity, assay, values of metal contents and other particulars of the concentrates or products produced or recovered under this license

and the assay of the tailings. The Licensees shall if so required by the Licensors verify the said accounts by affidavit. The said quarterly accounts shall be delivered to the Licensors within thirty (30) days after the expiration of each quarter, viz., within thirty (30) days after March 31st, June 30th, September 30th and De-
5522 cember 31st, starting with the quarter day immediately following the date of this license. The Licensees shall within ten days thereafter pay to the Licensors free of exchange in New York the full amount thereby shown to be due.

3. The Licensees shall during the continuance of this License promptly communicate and explain to the Licensors every invention or discovery made or used by them which may be an improvement modification or addition to any of the inventions specified in the Letters Patent within this License or may be useful in carrying out any of the processes thereby protected or any addition thereto or modification thereof whether patentable or not which the said Licensees may use or be or become possessed of. All such inventions and discoveries shall so be available for use by the Licensees as if they were contained in the Letters Patent within this License and subject thereto the Licensors shall be entitled to have the full benefit of and if obtainable to obtain Letters Patent for any such improvements or discoveries communicated to them by the Licensees, which said Letters Patent shall be and become the property of the Licensors and the Licensees shall render all assistance in their power for that purpose, provided that the Licensors shall bear all the charges and expense of obtaining such Letters Patent for all or any of such parts of the world as they may desire to protect or apply for, and such Letters Patent when obtained shall be and become Letters Patent within this License, and the Licensees shall so far as
5523 practicable bind their employees to assign or transfer to the Licensors any inventions made by such employees during their period of employment by the Licensees. The Licensees shall not without the written consent of the Licensors during the continuance of this License use or employ any improvement modification or addition to any of the inventions specified in the Letters Patent within this License which said improvement modification or addition is not the property of the Licensors.

4. The Licensors shall whenever required (on the Licensees paying out of pocket expenses) give all assistance, information and advice in their power as to the working of any of the said inventions and shall use their best endeavors to enable the Licensees to use and exercise said inventions to the best advantage, and in like manner the Licensees shall use their utmost endeavors to promote the success of the said inventions and enable them to be used and exercised to the best advantage.

5. The Licensees shall not directly or indirectly during the continuance of this License nor at any time after the determination thereof dispute or object to the validity of the Letters Patent within this License or the novelty or utility of the inventions specified herein.

6. The Licensees shall not either directly or indirectly during the

continuance of the Letters Patent within this License or any of them use the said inventions or processes or any improvement or modification thereof or addition thereto otherwise than in accord-
5524 ance with these presents, and the Licensees hereby undertake and agree that they, their officers and agents, will not in any way directly or indirectly support or assist third or hostile parties in any litigation either against the Licensors or any Licensees of the Licensors or against Minerals Separation, Limited, of London, England, or its subsidiary or associated companies or successors owning patents in the British Empire or any foreign countries for the inventions protected by the Letters Patent within this license, or its or their Licensees, or by the Licensors or said Minerals Separation, Limited, or said other companies, against others.

7. The Licensees shall not assign or sublet this License or sell or dispose of any machinery or apparatus the subject matter of any of the said Letters Patent without the written consent of the Licensors such consent not to be withheld in the case of a bona fide sale of the Licensees' undertaking or a substantial part thereof to a responsible person or company who will undertake to enter into a License when called upon so to do by the Licensors in the same terms as near as may be as are herein contained (but subject to the approval of the Licensors) and the Licensors agree to execute if called upon so to do such a License to such bona fide purchaser.

8. The Licensees shall permit the officers or the duly authorized representatives of the Licensors at all reasonable times during the continuance of this License to enter upon the works and
5525 property of the Licensees and inspect the plant and processes there being used according to the inventions contained in the Letters Patent within this License and to take any samples and to make such assays analyses or tests as may be desirable for the purpose of checking the Licensees' accounts or testing the said plant or processes and will also permit should the Licensors or their agents so desire reasonable access to intending Licensees to see the plant at work.

9. The Licensees shall at any time if so required supply to the Licensors or their duly authorized representatives full detailed information as to the working of any of the inventions the subject matter of any of the Letters Patent within this License. And the Licensees shall not without the written consent of the Licensors communicate any detail connected with the working of any of the said inventions modifications, additions or improvements to any third party.

10. The Licensors when required by the Licensees but at the cost of the Licensees shall prepare and supply as soon as may be possible plans and specifications of the plant for the working of the said inventions. The Licensors shall if requested by the Licensees and as soon as may be possible to send to the Licensees' said works an engineer or member of its staff to advise as to the operation of the said inventions. The Licensees shall pay the salary of the said advisor which shall be at the rate of — dollars per month for such period of time as he shall be engaged in such advisory capacity includ-

ing the time spent in travel to and from the works of the Licensees, such period of time to be mutually agreed upon, and the Licensees shall pay all legitimate expenses traveling and otherwise of said advisor from the time the said advisor shall start for such works until he shall return therefrom.

11. The Licensors hereby covenant with the Licensees that the Licensees paying the royalties hereby reserved and observing and performing the covenants on their part herein contained shall at all times during the term of years for which the Letters Patent within this License are granted or any extension thereof peaceably and quietly hold, exercise and enjoy the License hereby granted without any interruption or disturbance by the Licensors or any person lawfully claiming by, through or in trust for them.

12. In the event of any proceedings being taken against the Licensees for the infringement of any patent rights in the use or exercise of any invention for the time being subject to this License the Licensors shall have the right at their own cost to defend any such proceedings in the name of and on behalf of the Licensees and the Licensees hereby agree to render to the Licensors all possible aid (other than monetary) in connection with such proceedings and to notify immediately the Licensors in writing in the event of any such proceedings being instituted. And the Licensors shall pay all costs charges and expenses incurred by reason of any such proceedings so to be defended and taken over by them (the Licensors) as aforesaid. Provided that if any proceedings are taken against the Licensees by parties whom the Licensees are precluded by contractual relations from raising any of the defenses open to them and the Licensors elect to defend such proceedings in the name of the Licensees then the Licensees shall bear and pay all costs and damages in connection therewith.

13. Provided always that if any royalties payable hereunder by the Licensees or any part thereof respectively shall remain unpaid for thirty days after the time hereinbefore appointed for payment thereof whether demanded or not or if the Licensees shall make default in any other obligation by them herein contained and in case the non-payment of royalties or of any breach capable of being made good shall for the space of thirty days after they shall have been served with a notice in writing by the Licensors to make good such non-payment or breach neglect or omit so to do or if Licensees should cease for the period of twelve calendar months to use and work the said inventions or should be wound up by reason of inability to meet their liabilities then the Licensors at any time thereafter and notwithstanding any merely implied waiver by them of their rights so to do may by serving the Licensees or their liquidator (if any) with a notice in writing for this purpose forthwith revoke this License without prejudice however to the recovery by the Licensors of any money then already due or any right of action by or on behalf of them for past breaches accrued hereunder.

14. This contract shall be construed in all respects and take effect

as a contract made in the State of New York, and in accordance with the Laws of said State.

15. Any notice hereunder may be given by either party to the other of them by sending it through the post in a prepaid registered letter addressed to them at the address designated by the other party and last known to the party sending said notice and such notice shall be deemed to have been served in due course of post, and in proving the service thereof it shall be sufficient to show that the letter containing the same was properly addressed and registered.

Signed, sealed and delivered by the parties hereto, in duplicate, the day and year first above written.

—— ——.

Attest:

—— ——.

—— ——.

Attest:

—— ——.

5529 STATE OF ——,
County of ——, *ss:*

On the — day of —— in the year One thousand nine hundred and —, before me personally came —— ——, to me known, who, being by me duly sworn, did depose and say that he resides in —— ——; that he is the — of the Minerals Separation North American Corporation, the licensor corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order; and he acknowledged the said instrument to be the free act and deed of the said corporation.

—— ——.

5530 STATE OF ——,
County of ——, *ss:*

On the — day of ——, in the year One thousand nine hundred and —, before me personally came —— ——, to me known, who, being by me duly sworn, did depose and say that he resides in ——; that he is the — of the ——, the licensee corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order; and he acknowledged the said instrument to be the free act and deed of the said corporation.

—— ——.

United States Letters Patent.

Nos.	Date.	Name.	Description.
763,259	June 21, 1904	A. E. Cattermole	Classification of the Metallic Constituents of Ores.
763,260	June 21, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue.
763,749	June 28, 1904	Goyder & Laughton	Separation of Minerals.
776,145	Nov. 29, 1904	C. V. Potter	Process of Separating Metals from Sulphide Ores.
777,273	Dec. 13, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue.
777,274	Dec. 13, 1904	Cattermole, Sulman & Picard	Concentration of Minerals from Ores.
784,999	Mar. 14, 1905	Goyder & Laughton	Separating and Concentrating Minerals.
788,247	Apr. 25, 1905	Cattermole, Sulman & Picard	Ore Concentration.
793,808	July 4, 1905	Sulman & Picard	Ore Concentration.
809,959	Jan. 16, 1906	E. B. Kirby	Process of separating minerals.
835,120	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration.
835,143	Nov. 6, 1906	H. L. Sulman	Ore Concentration.
835,794	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration.
838,626	Dec. 18, 1906	E. B. Kirby	Separating Tank.
864,597	Aug. 27, 1907	A. J. F. De Bavay	Separating Zinc Blende by Flotation.
879,985	Feb. 25, 1908	H. L. Sulman	Separation of Metalliferous Minerals from Gangue.
902,018	Oct. 27, 1908	H. L. & E. S. Sulman	Ore Concentration.
912,783	Feb. 16, 1909	A. J. F. De Bavay	Apparatus for Separating Ores.
953,746	Apr. 5, 1910	T. J. Hoover	Apparatus for Ore Concentration.
955,012	Apr. 12, 1910	H. L. Sulman	Ore Concentration.
962,678	June 26, 1910	Sulman, Greenway & Higgins	Ore Concentration.
979,857	Dec. 13, 1910	T. J. Hoover	Apparatus for ore concentration.

1,045,970	Dec. 3, 1912	T. J. Greenway	Separation of Metallic Sulphide from Sulphide ores.
1,064,209	June 10, 1913	James Hebbard	Apparatus for Ore Concentration.
1,064,723	June 17, 1913	Greenway & Layers	Ore Concentration.
1,067,485	July 15, 1913	Nutter & Lavers	Ore Concentration.
1,071,784	Sept. 3, 1913	E. H. Nutter	Valve for Thick Pulp.
1,079,107	Nov. 18, 1913	Chapman & Tucker	Ore Concentration.
1,084,196	Jan. 13, 1914	Broadbridge & Howard	Apparatus for Ore Concentration.
1,084,210	Jan. 13, 1914	A. C. Howard	Agitating Apparatus.
1,093,463	Apr. 14, 1914	Nutter & Hoover	Method and Apparatus for ore concentration.

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1,099,699	June 9, 1914	H. H. Greenway	Ore concentration,
1,101,506	June 23, 1914	Leslie Bradford	Process and apparatus for separation of metallic sulphide from gangue.
1,102,738	July 7, 1914	Greenway & Lowry	Ore concentration.
1,102,873	July 7, 1914	Chapman & Tucker	Ore concentration.
1,102,874	July 7, 1914	G. A. Chapman	Ore concentration.
1,142,821	June 15, 1915	Henry Lavers	Separation of mixed sulphide ores.
1,142,822	June 15, 1915	J. W. Littleford	Ore concentration.
1,155,815	Oct. 5, 1915	Higgins & Stenning	Apparatus for ore concentration.
1,155,816	Oct. 5, 1915	A. H. Higgins	Apparatus for ore concentration.
1,155,836	Oct. 5, 1915	T. M. Owen	Apparatus for the concentration of ores.
1,155,861	Oct. 5, 1915	L. A. Wood	Ore concentration.
1,170,637	Feb. 8, 1916	A. H. Higgins	Ore concentration.
1,170,665	Feb. 8, 1916	E. H. Nutter	Ore concentration.
1,178,191	Apr. 4, 1916	Sulman & Picard	Copper Precipitant.
1,187,772	June 20, 1916	G. E. Ohrn	Ore concentration.
1,203,341	Oct. 31, 1916	A. C. Howard	Ore concentration.
1,203,372	Oct. 31, 1916	F. J. Lyster	Separation of metallic sulphide ores.

The Schedule Above Referred To.—Continued.

Nos.	Date.	Name.	Description.
1,203,373	Oct. 31, 1916	F. J. Lyster	Ore concentration.
1,203,374	Oct. 31, 1916	F. J. Lyster	Ore concentration.
1,203,375	Oct. 31, 1916	F. J. Lyster	Ore concentration.
1,208,171	Dec. 12, 1916	Lavers, Lowry & Greenway	Concentration of sulphide ores.
1,208,334	Dec. 12, 1916	Lavers, Greenway & Lowry	Ore concentration.

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5533 Plaintiff's Exhibit No. 293.

Model—Kirby Mixing Tank "A."

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 294.

Model—Separating Tank "B."

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 295.

Model—Gabbett Machine.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 296.

Model—Cattermole Upcasting Machine.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 297.

Model—Slide Gabbett Machine.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 298.

Bar Mixer.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

Plaintiff's Exhibit No. 299.

Batea.

(Physical Exhibit.)

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

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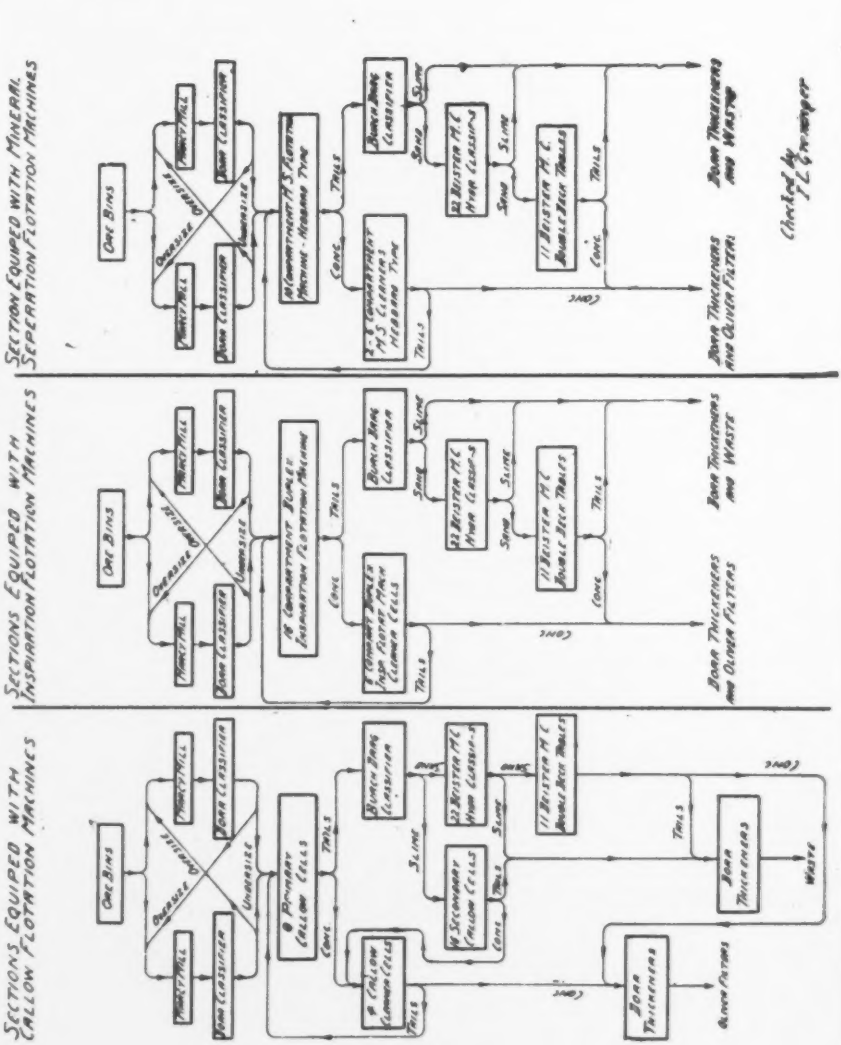
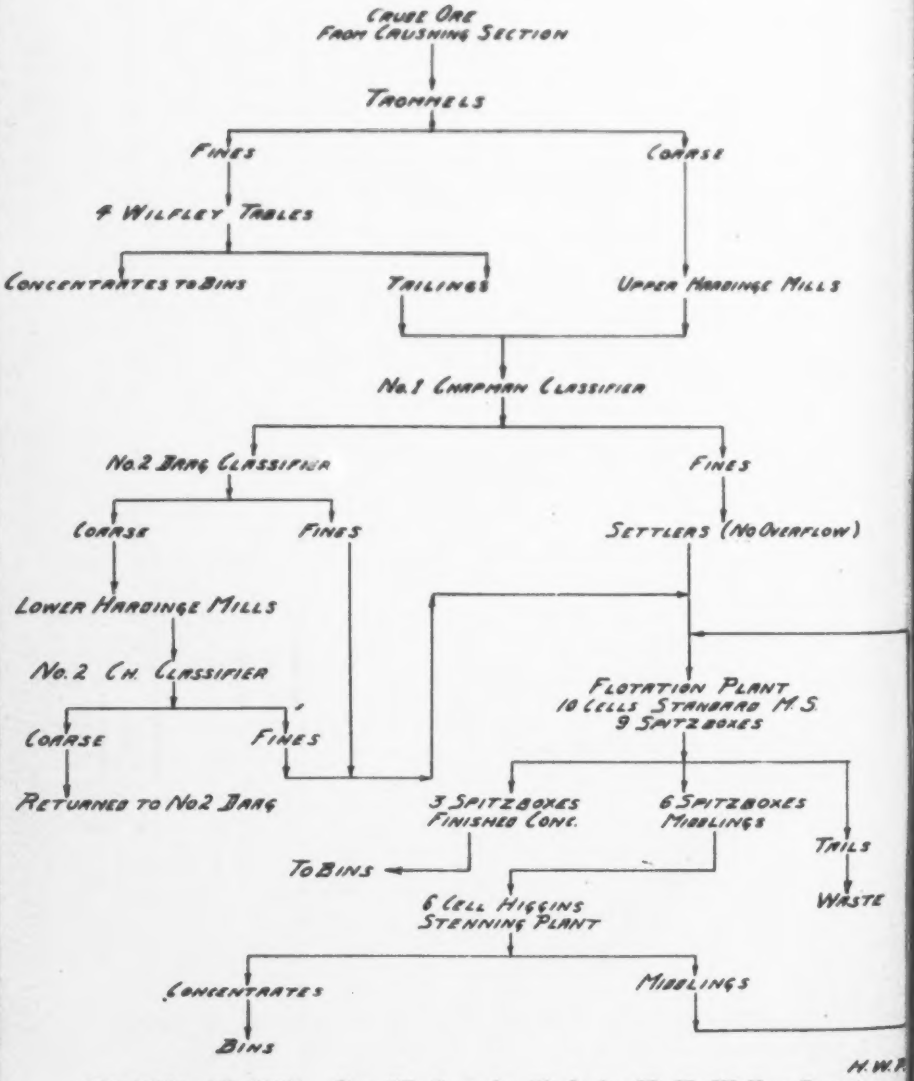


Filed May 18. 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5535

PLAINTIFF'S EXHIBIT NO. 301

FLOW SHEET—BABEN COPPER CO.—OLD MILL MOLINE, CHILE



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5536 Defendant's Exhibit No. 302.

Results of an Experiment Performed in Court and Testified to by B. H. Dosenbach.

Miniature Flotation Plant.

Test No. 39.

Operation of Miniature Flotation Plant (Def. Exhibit No. 226) in Court by B. H. Dosenbach.

Page 1863 (Description).

Ore used ..... 60 Pounds

Butte & Superior ore containing 14.65% zinc.

Water used ..... 146 Pounds

Ordinary tap water at temperature of 16° Centigrade.

Oil used ..... 1.266 Pounds

Butte & Superior Oil Mixture consisting of 70% fuel oil, 18% pine oil and 12% kerosene.

Amount of Oil Relative to Ore, 2.11%.

Acid used ..... 65 cc.

Commercial sulphuric acid having a specific gravity of 59 degrees Be. This amount used as equivalent to 8 pounds per ton of ore.

Copper Sulphate Solution used..... 78 cc.

Anaconda Copper Mining Company's sulphate solution equivalent to approximately 0.10 pounds metallic copper per ton of ore.

Entire heading, % zinc.	Entire tailing, % zinc.	Entire concentrate.			Apparent recovery, % zinc.
		% zn.	% ins.	% oil.	
14.65	3.27	48.9	11.6	5.09	83.24

Special Samples.

(Cuts made during normal operations.)

Concentrate froth:

	% zinc.	% insol.	% oil.
1st, 2nd and 3rd cuts from recleaner..	56.2%	4.0%	5.59%
3rd and 4th cuts from recleaner.....	55.6%	4.8%	3.98%

Tailing sample:

Sample cut for court inspection..... 1.15%

Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Defendant's Exhibits Nos. 303, 304, and 305, marked pages 5537-39, 5542-3, and 5545.)

Defendant's Exhibit No. 303.

BUTTE & SUPERIOR MINING COMPANY

May 5, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

The enclosed data shows the weights and assays of screen analyses run on samples taken in the plant on April 29th, 1917, of which description was reported to you on May 1st.

The screens reported here are as follows:—

A composite of flotation feed samples, general mill tailings, also a composite, primary tailings, primary middlings, cleaner flotation concentrates, slime feed to the sludge tank, and tube mill discharge. Concentrates from the first, second and third spitz and the first, second and third cleaner tailings were not screened as the rejects were too small to permit.

Yours truly,

(Signed) T. R. FEARLERLY,
Head Sampler.

TRF:JDS

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917.

Mesh	Weight	% Weight	Accumulative Per cent Weight	Weight Zinc	% Zn.	% Weight Zinc	Accumulative % Weight Zinc
Primary Middling—One Bucket 4th, 5th, 6th & 7th Spitz							
Original	400				10.8		
Plus 48	00.00	00.00					
65	15.00	3.79	3.79	2.69	17.9	6.17	6.17
80	18.00	4.55	8.34	3.20	17.8	7.34	13.51
100	13.00	3.28	11.62	2.21	17.0	5.07	18.58
150	60.00	15.15	26.77	6.60	11 0	15.14	33.72
200	36.00	9.09	35.86	3.24	9.0	7.43	51.15
280	35.00	8.84	44.70	4.41	12.6	10.12	51.27
Minus 280	219.00	55.30	100.00	21.24	9.7	48.73	100.00
Total	396.00	100.00		43.59		100.00	
Cleaner Flotation Concentrates—Finished Product to Thickener Tanks One Bucket							
Original	400				45.2		
Plus 48							
65	13.0	3.28	3.28	5.04	38.8	2.88	2.88
80	8.0	2.02	5.30	3.26	40.7	1.87	4.75
100	22.0	5.56	10.86	9.26	42.1	5.30	10.05
150	50.0	12.63	23 49	22.60	45.2	12.93	22.98
200	29.0	7.32	30.81	13.51	46.6	7.73	30.71
-200	274.0	69.19	100.00	121.10	44.2	69.29	100.00
Total	396.0	100.00		174.77		100.00	

NOTE:—Impossible to put through 280 mesh on account of material being too oily.

Slime Feed to Sludge Tank

Original	400.00				13.6		
Plus 80	10.0	2.51	2.51	1.41	14.1	2.90	2.90
100	15.0	3.77	6.28	1.58	10.5	3.25	6.15
150	65.0	16.33	22.61	6.11	9.4	12.60	18.75
200	40.0	10.05	32.66	4.60	11.5	9.47	28.22
- 200	268.0	67.34	100.00	34.84	13.0	71.78	100.00
Total	398.0	100.0		48.54		100.0	

TUBE MILL DISCHARGE

No. 4 Section 1 and No. 1 Section 2

Original	400.00				8.9		
Plus 48	37.0	9.30	9.30	1.67	4.5	4.45	4.45
65	75.0	18.84	28.14	4.13	5.5	11.00	15.45
80	49.0	12.31	40.45	3.38	6.9	9.01	24.46
100	62.0	15.58	56.03	5.08	8.2	13.54	38.00
150	78.0	19.60	75.63	9.13	11.7	24.33	62.33
200	23.0	5.78	81.41	3.11	13.5	8.28	70.61
- 200	74.0	18.59	100.00	11.03	14.9	29.39	100 00
Total	398.0	100.00		37.53		100.00	

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917

Mesh	Weight	Per cent Weight	Accumulative Per cent Weight	Zinc	Per cent Zinc	Iron	Per cent Iron	Accumulative Per cent Weight Zinc
General Mill Tailings Composite—Three Buckets						1.57		
Original	400.00							
Plus 48	10.00	2.53	2.53	.40	3.95	5.71	5.71	5.71
65	40.00	10.10	12.63	1.30	3.25	18.57	24.28	24.28
80	32.00	8.08	20.71	.69	2.15	9.86	34.14	34.14
100	35.00	8.84	29.55	.49	1.40	7.00	41.14	41.14
150	58.00	14.65	44.20	.65	1.12	9.29	50.43	50.43
200	60.00	15.15	59.35	.64	1.07	9.14	59.57	59.57
280	20.00	5.05	64.40	.15	.77	2.14	61.71	61.71
- 280	141.00	35.60	100.00	2.68	1.90	38.29	100.00	100.00
Total	396.00	100.00		7.00		100.00		
Primary Tailings—One Bucket						1.16		
Original	400.00							
Plus 48	15.00	3.77	3.77	.56	3.70	10.31	10.31	10.31
65	58.00	14.61	18.38	1.74	3.00	32.04	42.35	42.35
80	19.00	4.79	23.17	.33	1.75	6.08	48.43	48.43
100	40.00	10.07	33.24	.50	1.25	9.21	57.64	57.64
150	78.00	19.65	52.89	.68	.87	12.52	70.16	70.16
200	42.00	10.58	63.47	.26	.62	4.70	74.95	74.95
280	35.00	8.82	72.29	.20	.57	3.69	78.64	78.64
- 280	110.00	27.71	100.00	1.16	1.04	21.36	100.00	100.00
Total	397.00	100.00		5.43		100.00		
Flotation Feed Composite—Six Buckets						12.6		
Original	400.00							
Plus 48	5.00	1.27	1.27	.43	8.5	.85	.85	.85
65	37.00	9.37	10.64	4.74	12.8	9.36	10.21	10.21
80	25.00	6.33	16.97	3.30	13.2	6.51	16.72	16.72
100	30.00	7.59	24.56	4.32	14.4	8.53	25.25	25.25
150	57.00	14.68	39.24	7.42	12.8	14.65	39.90	39.90
200	31.00	8.10	47.34	3.84	12.0	7.58	47.48	47.48
280	39.00	9.87	57.21	4.80	12.3	9.48	56.96	56.96
- 280	169.00	42.79	100.00	21.80	12.9	43.04	100.00	100.00
Total	395.00	100.00		50.65		100.00		

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 304.

RESULTS OF EXPERIMENTS PERFORMED IN COURT AND TESTIFIED TO BY B. H. DOSENBACH

Operation	Refer. Record Page-No.	Apparatus	ORE USED						OIL USED			ACIDs		WATER			ASSAYS				
			Kind	Amt. Grams	% Zn.	% Cu.	% Fe.	% Insol.	Kind	Amt. Grams	% Oil to Ore	Kind	Amount c.c. Grams	Amt c.c.	Temp. Deg. C.		% Zinc	% Cu.	% Ins.	% Fe.	% Oil
Everson Test No. 30	Page 1211 1212	After Description in Fryer Hill Publication	Cu.	300		8.14	4.90	78.0	Petroleum Distillate	51	17%	Sulphuric	2.4 4.41	1250	42°	Mineral Froth		226.60	12.0	25.92	4.85
Everson Test No. 31	" 1223	Cattarract	Cu.	300		6.14	6.65	74.5	Texas Distillate	34	17%	"	1.6 2.94	1250	30°	Mineral Froth		23.67	20.8	22.5	6.65
Kirby Test No. 32	" 1224 " 1228	Sq. Glass agitator	Cu	300		5.87	6.76	75.4	Petroleum Distillate	75	25%	"	2.0 3.68	1500	25°	Mineral Froth		23.94	21.0	23.5	9.62
Butte & Superior	" 1261	Sq. Glass agitator	Zn.	300	17.4			64.0	Oil Mixture	4.5	1.5	Copper Sul. Sulphuric	.51 1.102 .67 1.23	1500	30°	Mineral Froth	47.10		16.0		0.64
Alternate Cattermole & Pat in suit Test No. 33	" 1262 " 1263	Cone Gabbett Mach.	Zn.	300	14.7	0.16	1.94	67.0	Oleic Acid	4.5	1.5	Sulphuric	1.0 1.84	1500	35°	Mineral Froth					
																1st	42.60		15.40		
																2nd	40.70		16.00		
																Cattermole Granules	32.70		35.60		2.03
																Upcast Overflow	3.90		87.80		1.12
Butte & Superior Test No. 36	1263	"	Zn.	300	14.7			67.0	Pine Tar Oil	4.865	1.62%	Sulphuric	.05 .92	1250	35°	Mineral Froth	33.90		31.20		3.39

Filed May 18 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 305.

RESULTS OF AN EXPERIMENT PERFORMED IN COURT AND TESTIFIED TO BY B. H. DOSENBACH

Test No. 34.

Operation performed in Janney Flotation Machine (Def. Exhibit No.) Page 1273.

Ore used 400 Grams
Butte & Superior ore containing 15.3% zinc.

Water used 1900 c.c.
Ordinary tap water at a temperature of 30° Centigrad.

Oil used 1½% relative to ore
Butte & Superior oil mixture, consisting of 70% fuel oil, 18% pine oil and 12% kerosene.
6 grams.

Acid used 0.9 c.c.
Concentrated sulphuric acid (Specific Gravity 1.84)

Copper Sulphate Solution 1.0 c.c.
Anaconda Copper Mining Company's copper sulphate solution; equivalent to 0.10 pounds per ton of ore.

Heading % Zinc	Tailing % Zinc	Concentrate % Zn.	Concentrate % Oil	Middling % Zinc	Apparent Recovery % Zinc
15.3	0.44	44.3	2.12	32.5	98.09

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

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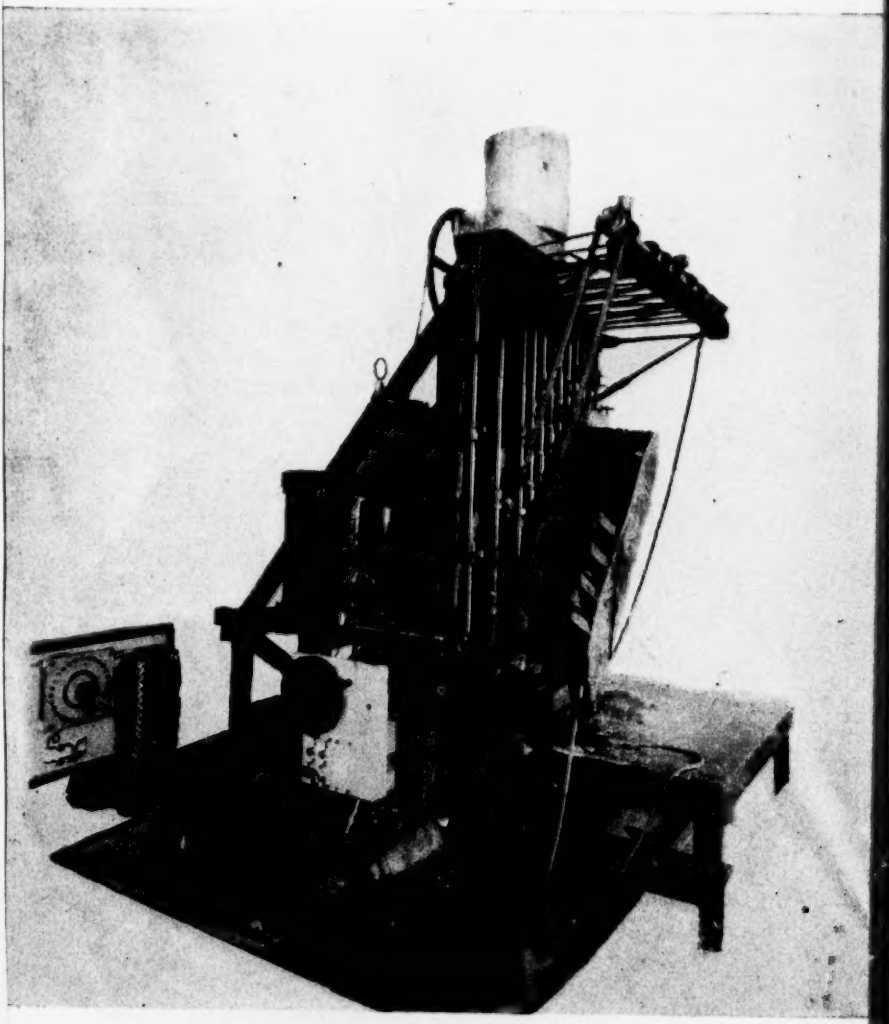
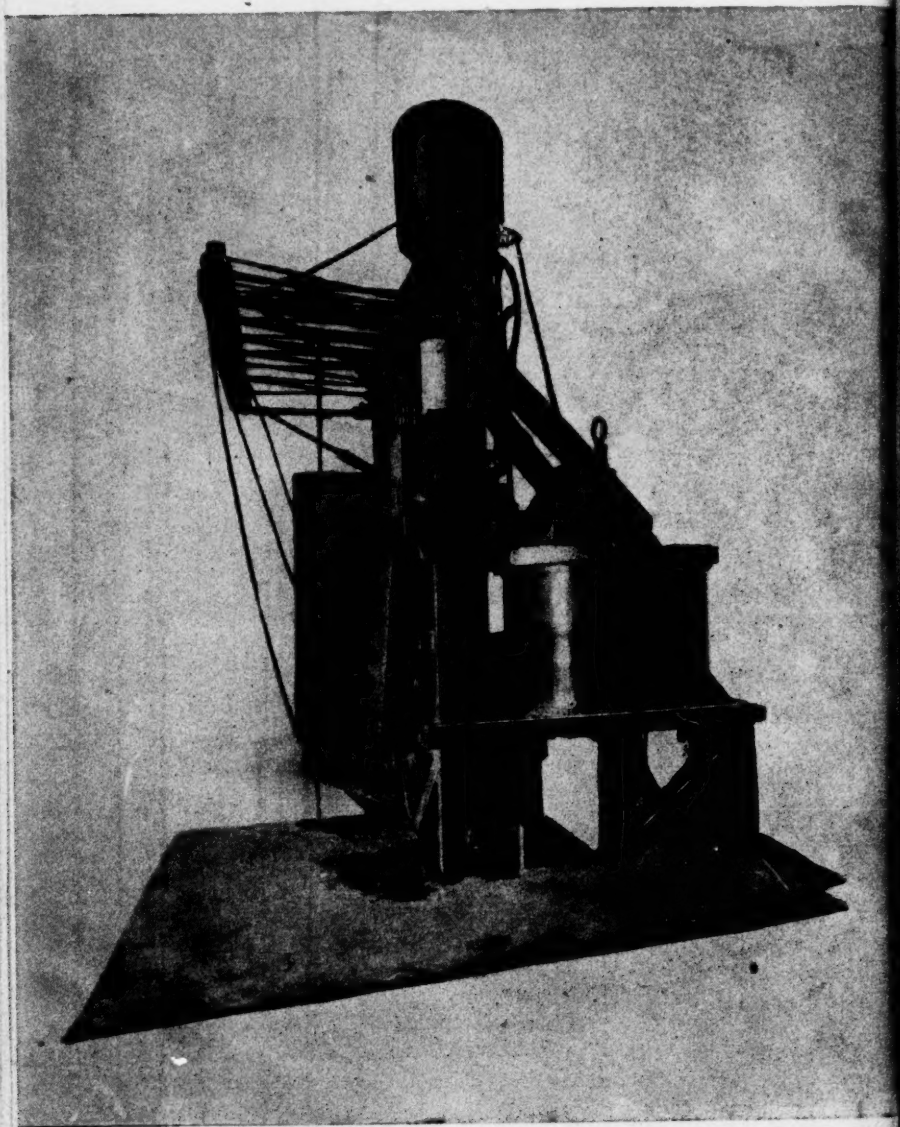
Defendant's Exhibit No. 306.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

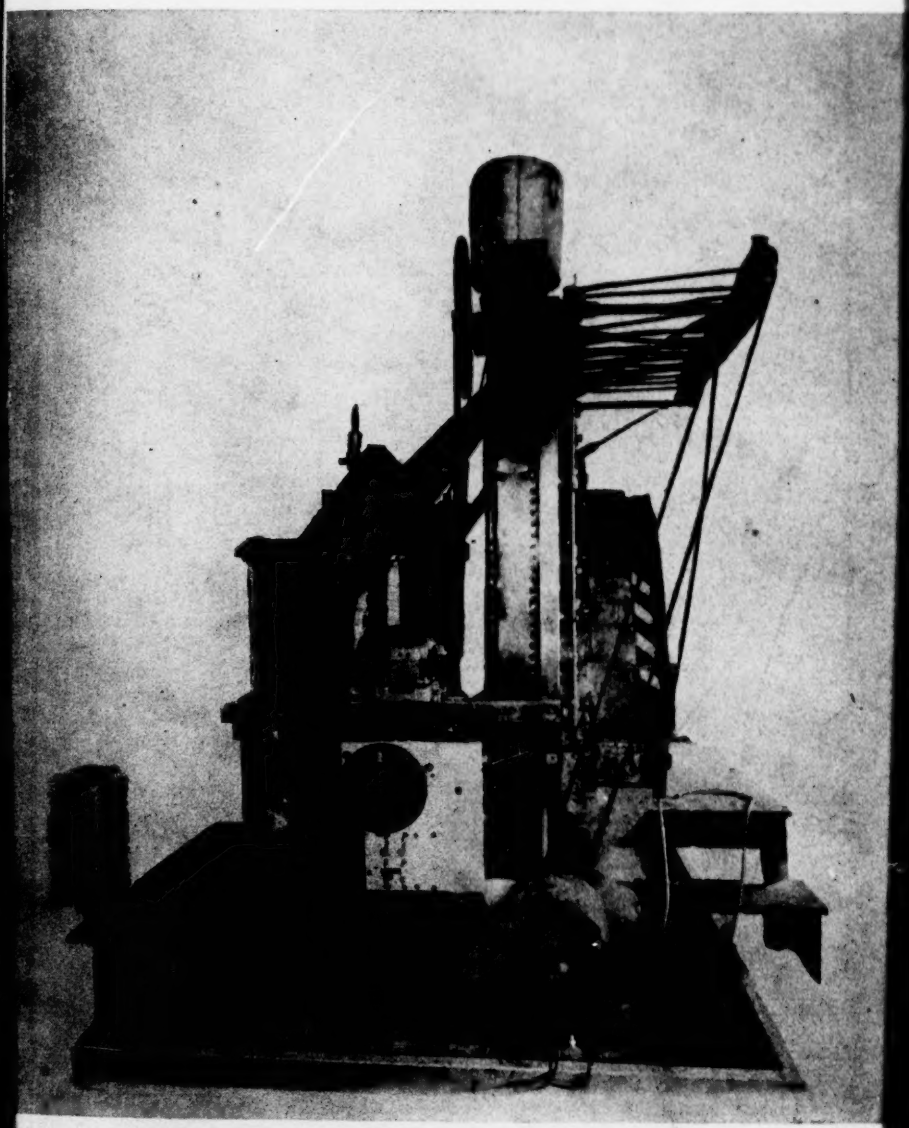
Defendant's Exhibit No. 307.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

5549-50

Defendant's Exhibit No. 308.



Filed May 18, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

(Here follow Exhibits Nos. 309 to 318, inclusive, marked pages 5551-56, 5558-9, and 5561-2.)

Plaintiffs' Exhibit No. 309.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed
March, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
Mar.	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4
1	3.5	.34	8.0	4.3	2.90	19.5	1.0	1.7	29.6
2	3.5	.36	7.7	3.9	2.14	14.1	1.0	1.9	27.6
3	3.6	.36	7.7	3.4	2.51	14.3	1.1	1.8	29.0
4	3.7	.34	7.7	4.2	2.85	19.2	1.1	2.3	28.6
5	3.7	.38	7.9	3.6	2.59	16.2	0.9	1.8	26.5
6	3.7	.34	7.6	4.0	2.71	18.1	0.9	1.7	19.0
7	3.7	.32	7.8	4.0	2.72	17.2	0.8	1.9	26.7
8	3.6	.33	7.9	3.5	2.34	15.0	0.8	1.6	20.7
9	3.7	.31	7.7	3.5	2.38	15.1	0.9	1.6	21.1
10	3.5	.38	7.8	3.4	2.33	15.0	1.5	2.0	25.0
11	3.7	.27	7.9	3.7	2.45	17.3	1.2	1.4	21.4
12	3.7	.32	7.9	3.4	2.20	13.6	0.9	1.4	24.6
13	3.6	.34	7.9	3.6	2.48	15.6	1.0	1.6	33.6
14	3.4	.18	7.9	3.8	2.66	16.8	0.8	1.1	19.0
15	3.5	.22	8.1	4.4	2.69	18.6	0.9	1.6	22.0
16	3.5	None	8.0	3.4	1.92	15.6	0.8	1.4	25.2
17	3.4	.17	8.1	3.9	2.22	16.4	0.8	1.4	23.8
18	3.5	.15	8.1	3.7	2.25	16.4	0.9	1.8	21.3
19	3.4	None	7.9	3.6	2.18	16.2	0.8	1.3	24.2
20	3.4	.41	7.8	3.8	2.32	16.4	1.6	1.5	24.6
21	3.3	None	7.8	3.4	2.16	14.9	1.0	1.9	21.9
22	3.2	.18	8.0	3.3	1.99	14.3	1.0	1.8	29.9
23	3.2	.24	8.1	3.8	2.26	16.8	0.8	1.6	28.4
24	3.3	.20	8.6	3.9	2.25	17.4	0.8	2.0	24.0
25	3.2	.50	8.0	3.6	2.01	14.7	Plant Down		
26	3.1	.30	8.0	3.9	2.31	16.9	1.0	2.4	27.4
27	3.2	.50	8.5	3.7	2.37	17.2	0.9	1.9	33.4
28	3.1	.45	8.2	3.2	1.78	14.1	0.8	1.6	30.3
29	3.1	.40	8.1	3.7	2.34	17.5	1.0	1.5	29.6
30	3.1	.48	8.1	2.9	1.68	13.6	1.2	1.8	29.0
31	3.1	.24	8.2	3.3	1.88	15.1	1.7	1.5	33.8

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 310.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed

February, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
Feb.	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4
1	3.5	.57	7.1	3.0	1.94	12.8	1.4	2.5	31.9
2	3.5	.41	7.0	3.0	1.85	12.0	1.0	2.0	19.3
3	3.6	.38	7.1	2.9	1.70	12.0	0.8	1.5	24.6
4	3.3	.32	7.0	3.2	2.19	11.3	1.1	1.5	28.0
5	3.3	.38	7.0	2.8	1.59	11.8	1.2	1.8	23.9
6	3.1	.41	7.2	3.6	2.06	13.5		Missing	
7	2.8	.39	7.3	4.9	2.10	14.8	0.9	1.6	31.9
8	3.3	.38	7.6	4.1	2.00	16.4	0.8	1.5	30.8
9	3.4	.35	7.4	5.3	2.50	21.7	1.0	1.9	30.5
10	3.3	.29	7.3	5.0	2.20	18.9	0.6	1.5	17.5
11	3.4	.24	7.4	3.9	1.65	14.7	0.8	1.6	20.7
12	3.4	.36	7.6	5.4	2.08	18.1	1.0	2.0	27.4
13	3.4	.34	7.6	5.4	1.80	18.7	0.9	1.8	24.0
14	3.4	.33	7.6	5.7	2.09	21.7	0.9	1.8	19.7
15	3.4	.26	7.5	5.8	1.85	21.4	0.8	1.9	17.0
16	3.6	.32	7.7	4.6	2.12	19.9	0.8	1.8	23.1
17	3.5	.31	7.8	5.7	3.10	24.4	1.1	2.2	26.0
18	3.6	.36	8.1	4.1	2.43	18.9	1.2	1.9	26.6
19	3.6	.32	7.8	3.9	2.54	19.2	0.8	2.0	24.7
20	3.8	.39	7.6	3.8	2.22	16.1	0.9	1.9	24.0
21	3.7	.37	7.9	3.8	2.20	17.2	1.0	1.9	18.5
22	3.7	.39	7.9	4.1	2.53	18.9	0.8	1.5	21.5
23	3.7	.24	7.7	3.9	2.41	17.9	0.8	1.8	26.3
24	3.6	.31	7.8	3.8	2.35	17.6	1.3	2.4	37.4
25	3.6	.45	7.8	3.9	2.42	17.0	1.5	2.0	34.6
26	3.6	.39	7.7	4.4	2.44	17.7	2.0	3.6	50.4
27	3.6	.28	7.8	4.1	2.28	21.1	1.0	2.2	30.6
28	3.6	.25	7.7	3.9	2.38	16.1	0.9	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 311.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—Lbs. per Ton of Flotation Feed

January, 1917

	COPPER SAND			COPPER SLIME			ZINC ORE		
Jan.	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4	Sludge	Creosote	H_2SO_4
1	2.6	.22	6.8	2.9	1.75	13.2	0.5	2.6	20.7
2	3.3	.20	6.9	2.9	1.70	13.7	1.1	3.0	22.2
3	3.1	.22	6.8	3.1	1.90	14.3	0.7	2.3	19.0
4	3.1	.24	6.9	3.7	2.20	15.3	0.8	2.6	19.0
5	3.2	.26	7.2	4.2	1.90	13.7	0.8	2.7	20.0
6	3.2	.24	7.4	3.6	2.10	15.6	0.9	2.8	19.9
7	3.1	.27	7.2	3.5	2.20	15.7	0.9	2.5	19.1
8	3.1	.25	7.1	3.3	1.95	14.3	0.8	2.5	20.4
9	3.1	.23	7.1	3.4	1.85	14.6	0.8	3.1	24.0
10	3.3	.32	7.3	3.2	1.90	13.2	0.9	2.5	23.0
11	3.2	.26	7.0	3.5	2.10	14.7	0.8	3.1	27.8
12	3.2	.27	7.0	3.5	2.15	15.4	0.8	3.0	30.8
13	3.2	.33	6.9	3.7	2.30	16.0	0.9	2.5	19.4
14	3.4	.24	7.3	3.6	2.35	15.8	0.9	2.9	32.4
15	3.4	.31	7.2	3.8	2.35	15.0	0.9	3.1	25.5
16	3.2	.17	7.0	3.5	2.10	14.9	0.8	2.7	17.7
17	3.1	.23	7.0	3.4	2.15	15.0	0.8	2.9	21.5
18	3.4	.32	7.1	3.7	2.25	14.7	0.4	2.2	22.1
19	3.3	.27	7.1	3.7	2.30	14.9	0.6	2.3	23.9
20	3.4	.26	7.3	3.7	2.25	15.1	0.3	2.5	19.8
21	3.4	.30	7.5	3.6	2.20	14.8	0.9	3.0	28.4
22	3.4	.30	7.2	3.5	2.50	14.2	0.9	2.5	25.5
23	3.4	.41	7.1	3.4	2.20	13.6	0.7	2.6	22.7
24	3.3	.43	7.1	3.4	1.90	13.0	0.8	1.9	19.1
25	3.4	.36	7.1	3.3	2.05	12.9	0.7	2.1	26.4
26	3.4	.37	7.4	3.4	2.15	13.2	0.9	2.8	29.5
27	3.0	.38	7.3	3.8	2.25	14.2	0.8	2.4	28.9
28	3.4	.39	7.2	3.5	2.40	13.5	0.7	2.3	28.1
29	3.4	.50	7.3	3.8	2.05	13.0	1.0	2.2	32.0
30	3.0	.32	7.6	4.0	2.20	14.8	1.2	2.4	26.9
31	3.4	.49	7.4	3.3	1.90	13.0	1.1	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 312.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Current Mill Slime—Per Cent Cu.

	JANUARY	FEBRUARY	MARCH
1	2.63	2.44	2.51
2	2.63	2.71	2.80
3	2.47	2.78	2.57
4	2.75	2.65	2.66
5	2.67	2.60	2.39
6	3.06	2.81	2.60
7	2.31	2.61	2.30
8	2.67	2.40	2.47
9	2.69	2.77	2.46
10	2.50	2.83	2.73
11	2.60	2.65	2.81
12	2.81	2.68	2.45
13	2.47	2.65	2.93
14	2.65	2.72	2.81
15	2.54	2.61	2.41
16	2.82	2.96	2.33
17	2.66	2.40	2.64
18	2.73	2.44	2.51
19	2.53	2.42	3.07
20	2.66	2.77	2.76
21	2.82	2.25	2.7[illegible]
22	2.73	2.70	2.84
23	2.57	2.52	2.54
24	2.76	2.71	2.38
25	2.60	2.63	3.15
26	2.82	2.77	2.62
27	3.10	2.37	2.49
28	2.54	2.85	2.74
29	2.70		2.69
30	2.84		2.83
31	2.67		2.83

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs Exhibit No. 313.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION

Reagent Consumption and Sulphide Content of Ore—Jan., 1917

							REAGENTS USED LBS. PER TON			
PRODUCT—	% Cu	% Pb	% Zn	% Fe	% S	% Sulphide	Sludge	Creosote	Total Oil	H2SO4
Copper Sand	1.0			4.0	5.0	10.3†	3.4	0.1	3.5	6.8
Slime	2.4			4.2	6.0	12.8	3.6	1.9	5.5	13.8
Zinc Ore	0.7	3.0	13.2	7.0	14.7	38.6	0.7	2.7‡	3.4	22.7

† Mixture of 60% Creosote from Cleveland Cliffs Iron Co., Marquette, Mich., and 40% Oil of Tar special from Georgia Pine Turpentine Co.

‡ In the mill operations we treat 0.578x2000=1156 tons of Sand and approximately 120 tons of slime in each section. Therefore, the true total sulphide figure for the "sand" flotation feed in the mill should be $\frac{1156X10+120X13.4}{1276}=10.3$. This accounts for discrepancy between figure shown and addition which would be 10.0%. The total sulphide in the slime returned to the mill for treatment is 13.4%.

Filed May 18, 1917. By H. H. WALKER, Deputy.
GEO. W. SPROUL, Clerk.

Plaintiffs' Exhibit No. 314.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION
Reagents Consumption and Sulphide Content of Ore—Feb. 1917

							REAGENTS USED LBS. PER TON			
PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe.	% S.	% Sulphide	Sludge	Creosote	Total Oil	H_2SO_4
(Mixed) Copper Sand	1.15			5.2	4.8	11.15	4.01	.13	4.14	6.89
Copper Slime	2.50			4.1	5.4	12.00	4.85	2.12	6.97	16.35
Zinc Ore	.69	2.8	12.35	7.5	12.6	35.94	1.00	2.40	3.40	27.30

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 315.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION
Reagent Consumption and Sulphide Content of Ore—Mar. 1917

							REAGENTS USED LBS. PER TON			
PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe.	% S.	% Sulphide	Sludge	Creosote	Total Oil	H_2SO_4
(Mixed) Copper Sand	1.24			5.5	4.9	11.64	2.94	.05	2.99	7.65
Copper Slime	2.40			4.3	5.5	12.20	3.15	2.11	5.26	15.46
Zinc Ore	.54	3.0	13.48	6.45	13.6	37.07	.80	1.44	2.24	24.14

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 316.

MINERALS SEPARATION COMPANY, LIMITED, ET AL., VS. BUTTE & SUPERIOR MINING COMPANY

Referring to Defendant's Exhibit No. 29 Chino Copper Company—Retreatment of Vanner Concentrates. Mr. Wick's Evidence Q 25 and Q 26.

PERIOD	HEADING TO FLOTATION			FLOTATION CONCENTRATES				RECOVERY % CU.		TAILINGS		Assay % Cu.		LOSS OF CU. IN TAILINGS PER LB. CU. IN HEADINGS		COST OF SMELTING CONCTS.		COST OF CONCENTRATION			OIL	OTHER REAGENTS
	Tons	Assay % Cu.	Contents Lbs. of Cu.	Ratio of Concentration	Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated by Contents	Given in Exh. 29	Tons by Difference	Contents lbs. of Cu. by Difference	Calculated by Contents	Given in Exh. 29	Lbs. in Tailings per lbs. in Heads	Val. if One lb. Cu. in Conc. be Worth 20c Nrt to the Mill.	Smelting Chg. & Frt. per Ton of Conc.	Total	Per Lb. Cu. in Heading	Cost of Oil per Lb. Cu. in Heading	Cost of Reagents per Lb. Cu. in Heading	Total Oil, Reagents & Loss in Tails (per Lb Cu. in Heads)	Lbs. per Ton of Heading	Lbs. per Ton of Heading
1916 3rd Quarter	26804	7.01	3757921	3.94	6804	27.10	3687768	98.13	96.717	20000	70153	.175	.306	0.0186	$0.00372	$6.00	$40824	$0.01086	$0.0153	$0.00137	0.01595	8.76	4.57
1916 October	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	6910	20578	.149	.200	0.0135	0.00270	6.00	17304	0.01136	0.0146	0.00147	0.01553	10.26	4.77
1916 Nov. 18, 19, 20	561	10.24	114893	2.95	190	29.78	113164	98.49	98.423	371	1729	.233	.244	0.01504	0.00301	6.00	1140	0.00992	0.00446	0.00136	0.01429	23.70	6.34

Recompiled May 13th, 1917, by F. R. Wicks

(15-18-20)

(Signed) F. R. Wicks

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 317.

B. & S. MINIATURE PLANT TEST.
MINERALS SEPARATION

PRODUCTS	Assays % Zn.	Recovery %
Concentrates	49.46	81.38
Tailings	3.51	
Crude	14.39	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 318.

ASSAYS OF HIGGINS' TESTS.
MINERALS SEPARATION

		Assay % Cu.	% Insols.	Recovery
Mr. Higgins	Crude	4.64	.....	.....
Test Illustration	Concs	14.12	17.65	79.8
of Bumping				
Table on Bates	Tails	1.27	.....	.....
—35 Mesh from Feed to				
Wilfley's Anaconda Plant				
COPPER, May 11th				
Mr. Higgins	Crude	4.64	.....	.....
Everson Test	Concs.	12.08	21.03	53.8
—35 Mesh from Feed to				
Wilfley's Anaconda Plant				
COPPER, May 11th	Tails	2.70	.....	.....
Mr. Higgins	Crude	0.51	.....	.....
Kirby Test	Concs.	1.26	36.01	34.4
Rossland Ore				
COPPER, May 11th	Tails	0.51	.....	.....
Mr. Higgins	Crude	20.68	.....	.....
Cattermole	Concs.	56.63	2.53	93.6
Test	Tails	1.99	.....	.....
BLACK ROCK				
RECEIVED 1912-13				
ZINC, May 11th				
Mr. Higgins				
Test on Solution	Crude	20.14	.....	.....
Patent	Concs.	44.86	7.25	87.3
B. H. T. ZINC	Tails	4.19	.....	.....
May 12th				

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

5563 The foregoing statement of the evidence and proceedings in the cause named in the caption hereof is in due time presented to the judge of this court and is approved by the judge aforesaid as true, complete and properly prepared in accordance with the stipulations made and entered into between the parties hereto.

Dated this 3 day of October, 1917.

GEO. M. BOURQUIN, *Judge.*

Statement of evidence and proceedings filed Oct. 10, 1917.

GEO. W. SPROULE, *Clerk,*
By HARRY H. WALKER,
Deputy Clerk.

5564 UNITED STATES OF AMERICA,
District of Montana,
County of Silverbow, ss:

I, George W. Sproule, Clerk of the District Court of the United States, for the District of Montana, do certify and return to the honorable, the United States Circuit Court of Appeals, for the Ninth Circuit, that the foregoing record, consisting of 5,793 pages, numbered from 1 to 230 and 1 to 5563, is a true and correct transcript of the pleadings, findings and conclusions of the court, decree, opinion of the court, statement of evidence and proceedings, stipulations and records therein, certificate of approval and other proceedings had in said cause and of the whole thereof, as appears from the original records filed in said court in my possession, the same being made up in accordance with the Præcipe heretofore delivered to me. And I do further certify and return that I have annexed to said transcript and included within said paging the original citation. I further certify that all exhibits have been and are herewith certified by me to be produced in court in accordance with the order of court. I further certify that the cost of the transcript of the record amounts to the sum of $2,177.00, and that the same has been paid by the appellant.

5565 In witness whereof, I have hereunto set my hand and affixed the seal of said court, at Butte, in the District of Montana, this 5th day of November, in the year of our Lord nineteen hundred and seventeen, and of the Independence of the United States, the one hundred and forty-second.

[SEAL.]

GEO. W. SPROULE,
Clerk of the District Court of the United States for the District of Montana,
By H. H. WALKER,
Deputy Clerk.

5566 United States District Court, District of Montana.

In Equity.

MINERALS SEPARATION, LIMITED, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, LIMITED, Defendant.

The examination of witnesses de bene esse and pursuant to order of court, beginning on the 5th day of May, 1914, on behalf of the plaintiff, before me, Harry C. Lewis, a notary public in and for the County of the Bronx, certificate filed in the County of New York and authorized to act as a Notary Public in the County of New York, State of New York, at the office of Henry D. Williams, Esq., No. 76 Williams Street, in the County of New York and said State, in the above entitled suit.

Present:

Henry D. Williams, Esq., of Counsel for the Plaintiff.
Thomas F. Sheridan, Esq., and Walter A. Scott, Esq., of Counsel for Defendant.

HUGH N. LINE, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows:

Direct examination.

By Mr. Williams:

1 Q. Please state your name, age, residence and occupation.
5567 A. Hugh N. Line; 41 years old; Bartlesville, Oklahoma; contractor for loading and unloading material for the smelters.
2 Q. And what is the material which you usually load and unload for the smeltery?
A. Coal and ore, I unload, and clay. I load cinders and do other work for the Company.
3 Q. And what is the name of the Company?
A. National Zinc.
4 Q. Please relate the circumstances connected with obtaining a specimen of ore or concentrate at the Bartlesville Zinc Company, near Bartlesville, Oklahoma.
A. On the 18th day of September, 1913, Mr. Gill and Mr. Jacobsen, they came where I was working and said they wanted me to do some work for them. I asked them to state the case and they told me they wanted me to secure a sample of ore from the Bartlesville Zinc Company at No. 2 Works, and they wanted a muddy slime called the Butte ore. I went and secured a sample. I was there present when the men opened the car. I went in and secured a sample. I then placed it in a bag marked "$100"—and I believe

it was the Bartlesville Union National Bank—I took it to the No. 3 office and gave it to Mr. Jacobsen and Mr. Gill. I also got the seal of the car and the number of it.

5 Q. Was the seal of the car broken in your presence?

A. Yes.

6 Q. What is this I now hand you (hands piece of tin)?

A. This is the seal as best I can tell, the same number; 833,664 and "Great Northern Ry. Line," with the letter "H" on the rivet of the seal.

7 Q. What is it I now hand you (handing slip of paper to witness)?

A. This is the number of the car and the title of it "S 15679."

8 Q. About how much of the material of which you took a specimen was there in the car?

A. I would judge there was 80,000 or 100,000 pounds in the car.

9 Q. What is the No. 3 Office, to which you took this sample?

5568 A. That is the National Zinc Company No. 3 Office.

10 Q. When did you put this specimen in the bag?

A. In a few minutes after I procured it.

11 Q. What further happened in regard to this specimen in the bag at No. 3 Office and afterward?

A. Well, we put it in there in the bag and sealed it up and I kept it in my possession until that evening; then we went to Rowland & Talbot and there we sealed it with red and green sealing wax.

12 Q. Did you put anything else in the bag besides the specimen of muddy slime?

A. Yes, sir, put the seal of the car and the number of the car on a white slip of paper, written with a pencil. And we tied the sack with a grayish twine and the imprint of the seal on the wax was Rowland & Talbot; then I delivered it to Mr. Jacobsen.

13 Q. What is it that I now show you (hands witness a bag)?

A. That is the bag I described or one just like it. The sealing and tying is the same or just like it. The material in the bag looks like the same material, dry.

14 Q. What is the document I now show you (hands witness document)?

A. That is the affidavit I made that day, signed and sworn to by me.

Mr. Williams: The metal seal shown to the witness is marked for identification "Seal of Car," the slip of paper described as containing the number of the car is marked for identification "Memorandum of Number of Car," and the bag shown to the witness, with attached sealing and contents, is marked for identification "Defendant's Concentrate No. 2," and the affidavit shown to the witness is marked "Line First Affidavit."

Direct examination closed.

No cross-examination.

Deposition closed.

5569 ERNEST O. JACOBSEN, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows:

Direct examination.

By Mr. Williams:

Q. 1. Please state your name, age, residence and occupation.

A. Ernest O. Jacobsen; 48 years old; living at 304 West Seventy-first street, New York City; secretary and treasurer of the National Zinc Company.

Q. 2. Where were you on September 18, 1913?

A. In Bartlesville, Oklahoma.

Q. 3. Where is the plant of the Bartlesville Zinc Company?

A. Near Bartlesville, Oklahoma.

Q. 4. Did you on that day meet Hugh N. Line, who has just testified as a witness, and what, if anything, did you ask him to do?

A. I met Mr. Line in conjunction with Mr. Gill, superintendent of the National Zinc Company's plant near Bartlesville, Oklahoma, and requested Mr. Line to obtain, if possible, a sample of ore known as the Butte & Superior ore arriving at the works of the Bartlesville Zinc Company.

Q. 5. And what, if anything, happened in relation thereto?

A. Mr. Line brought to me, while in the office of the National Zinc Company, a bag containing a wet substance, which he said he had obtained from a car at the Bartlesville Zinc Company's Works, and we went to the law office of Rowland & Talbot in the City of Bartlesville, where, in my presence, Mr. Line put in the bag a strip of tin and a piece of white paper, the latter being marked with the number which he said was the number of the car from which he had obtained the contents of the bag. The bag was then tied and sealed with a red and green seal and marked "Rowland & Talbot." Mr. Line thereupon gave me the bag, which I kept in my possession and brought with me to New York, delivering same to you.

6 Q. At the time that you delivered this bag and its contents to me, was or was not the bag still sealed up?

5570 A. The bag was still sealed up.

7 Q. When and in whose presence was the bag opened?

A. On the 25th of September, the day that I came into your office, the bag was opened in the presence of yourself, Dr. Charles F. Chandler and I think Mr. George A. Chapman was there, and myself. The contents of the bag were examined by all present, Dr. Chandler taking a sample.

8 Q. I now show you the bag which was marked for identification during the taking of the deposition of Mr. Line and the metal seal and piece of paper also so marked, and ask you whether or not they appear to be the various articles so described by you and delivered to me?

A. They do.

Direct examination closed.

No cross-examination.

Deposition closed.

Adjourned to Wednesday, May 6, 1914, at the same place, at eleven o'clock A. M.

New York, May 6, 1914.

Met pursuant to adjournment.
Present: Counsel as before.

CHARLES F. CHANDLER, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows:

Direct examination.

By Mr. Williams:

1 Q. Please state your name, age, residence and occupation?
A. Charles Frederick Chandler; age, 77 years; residence, New York City; chemist by profession.

2 Q. Are you the same Charles F. Chandler who testified
5571 as a witness for the complainants in the suit of Minerals Separation, Limited, and another, vs. James M. Hyde?

A. I am.

3 Q. Were you in my office on September 25, 1913, and, if so, please relate the circumstances in connection with a specimen which was present on that occasion?

A. I was present in your office on this date and, beside yourself, Mr. E. O. Jacobsen was present. A cotton bag was produced marked "$100 Silver" in red, and under that in black "Bartlesville National Bank, Bartlesville, Okla." In between the red and black descriptions above mentioned were two red lines which were very indistinct and I did not try to decipher them. The bag was tied with heavy hemp twine and sealed with red sealing wax, underneath which was dark green sealing wax. The seal covered the knot in full contact with it, and everything was intact. Just as the twine was cut by myself, Mr. George A. Chapman came in and remained to the end of the interview.

On opening the bag, a piece of white paper was found therein marked "Car No. S 15679." There was also found in the bag a narrow strip of tin plate about seven inches long and a third of an inch wide, with the following inscription in black: "Great Northern Ry. Line 833664"; and on the rivet head holding the two ends together originally appeared the letter "H."

The ore within the bag had become hardened into a solid lump. This was broken by physical force applied outside and the contents of the bag were poured out and thoroughly mixed. Half of this I took charge of and returned the other half to the bag, and tied it up as before and left it in the custody of Mr. Williams, together with the paper and strip of tin.

The moist ore, as well as the bag, had a very strong odor, apparently of an essential oil, probably eucalyptus.

This is the memorandum which I made at the time.

4 Q. What did you do with this specimen of ore that you took charge of?

A. I took it to my laboratory at Columbia University and subjected it to chemical examination. I weighed out 150 grams of the moist ore and extracted it repeatedly with ether. On evapo-
5572 rating the ether in a weighed dish, there was left an oily residuum which amounted in weight to 0.24 per cent. This appeared to be a mixture of light and heavy oil and, when cold, indicated the presence of stearic acid by becoming semi-solid, stearic acid being a common constituent of commercial oleic acid. The solubility of a considerable portion of the oily material in alcohol satisfied me that a large proportion of it was commercial oleic acid. From the odor of the original ore in its moist condition, I concluded that a portion of the oily matter was probably either pine oil or eucalyptus oil, I couldn't decide which. The water in the sample amounted to 3.29 per cent., probably a little less than this in fact, because the water was determined by subtracting the joint weight of the oil recovered and the dry ore freed from oil and water from 100 per cent.; probably the oil recovered did not completely represent the oil in the sample, as the odor which I thought came from eucalyptus oil or pine oil disappeared during the evaporation of the ether, so probably the amount of oil was a little more than 0.24 per cent. and the water less than 3.29.

The following tabular statement indicates the results actually obtained from this examination:

Mineral	96.47
Water	3.29
Oil	0.24
	100.00

I subjected the mineral, after it was freed from oil and water, to a partial chemical analysis, with the following result:

Zinc	42.22	
Sulphur calculated	20.71	
Sulphide of Zinc		62.93
Copper		0.62
Residue insoluble in acids		24.57
Undetermined		11.88
		100.00

5573 The undetermined includes iron, sulphur combined with the iron and the copper, manganese, carbon dioxide, and other substances dissolved by the acids used.

5 Q. Have you made a screen analysis of this material, and, if so, when did you make and with what results?

A. The end of April I came to Mr. Williams' office and borrowed the bag of ore that I have previously described, which had been left with him for safe keeping. I took it to the University. I found it had caked together again, I crushed it with my hands so as to get it out of the bag, and then broke up the lumps in a glazed porcelain

mortar, I did not triturate it; that is to say, I did not make the particles any finer than they were originally. I merely broke up the lumps so the material could be sifted. I weighed the whole and found that it amounted to 423.35 grams. I first tried it on a 80-mesh sieve and it all went through. I then sifted it on a 150-mesh sieve and 401 grams went through, leaving 22.35 grams that did not go through. Reduced to percentages, the figures are as follows:

94.72 per cent. passed through 150-mesh sieve.
5.28 " " did not.

100.00 " " through 80-mesh sieve.

I then returned both these portions to the rest of the contents of the bag and thoroughly mixed them and took 100 grams of the dry powder and extracted it with ether five times in succession. The ethereal solutions were evaporated in a weighed dish and the oily product, solid at room temperature, weighed 0.1165 grams, which, of course, represents the percentage. This is considerably smaller than the residue obtained originally last September, when the material was wet and fresh, owing to the fact that the more volatile portions of the oil had evaporated in the meantime, as was the case with the water originally recovered, and probably some of the oily matter had been rendered insoluble in ether by oxidation.

6 Q. Have you anything to add as to the analysis made by you in September, 1913?

A. There were two things that didn't occur to me to men-
5574 tion: one was that the sample that I treated with ether last September was put in a mortar and pulverized, simply to break up the lumps which had formed by agglutinating action of the water or the oil, not for the purpose of making the particles any smaller; and I omitted to mention the fact that last September I tested for sulphuric acid and hydrochloric acid; I obtained a slight reaction for each, but as the blue litmus paper was not reddened, the quantity must have been extremely small or the acid must have been neutralized probably by some constituent of the ore.

7 Q. What became of the portion of the specimen which you took from my office in September, 1913, and from which you took the 150 grams specimen for chemical analysis?

A. I returned it to you when the analysis was complete, and I now produce the bottle containing my laboratory number 4390 and marked "Original sample received from Mr. Williams, Sep. 25, 1913, C. F. Chandler,

Wt. Bottle..... 315.5 gram.
" " + Ore..... 617.5

Ore..... 302."

8. Q. I now show you a bag marked for identification "Defendant's Concentrate No. 2", a strip of tin marked for identiffcation

"Seal of Car," and a piece of white paper marked for identification "Memorandum of number of Car" and ask you if you recognize those articles?

A. I do. They are the ones which I have mentioned at the beginning of my testimony.

"Mr. Williams: The specimen in bottle, produced by the witness, is marked for identification "Original Chandler Sample".

9 Q. Relative to the amount of oil which you determined to be present in this material when examined by you in September, 1913, you say at the end of your answer to 4 Q.: "Probably the amount of oil was a little more than 0.24 per cent." Can you say any-
5575 thing further in amplification of this statement?

A. I can only say that this was an *inter*ference which I drew from the fact that I did not detect in the oil which I extracted the delicate odor which the original ore gave off and which led me to suspect the presence of some eucalyptus or pine oil. I had no other means of forming an opinion that the oil which I weighed did not represent all the oil in the original sample.

10 Q. Could you give any representation in figures of the probable amount of oil which may have evaporated?

A. I cannot. I know it takes a very small quantity of material having a characteristic odor to display that odor. As an illustration: the odor of whiskey, brandy, rum, wine, beer is produced by small fractions of one per cent. of material; in fact, strong odors are produced by unweighable quantities of material.

Direct examination closed.

Cross-examination.

By Mr. Scott:

11 X Q. The odor which was observed in the sample before extraction with ether, which odor disappeared after the evaporation with ether, simply indicated the fact that some oil disappeared without affording any indication as to how much disappeared?

A. Well, it indicated that the odor disappeared and that the substance which produced the odor probably disappeared, or else the odor of the ether employed may have masked the odor which the oil originally exhibited.

12 X Q. There is no certain way, is there, of determining just what did happen?

A. No. Oxidation may have occurred and rendered the oil odorless.

13 X Q. Did the oil which you finally obtained after the evaporation of the ether still have an odor of ether?

A. It did.

14 X Q. Thus indicating that the oil was not completely freed from the ether?

5576 A. Well, I shouldn't like to say that exactly, because there is an ethereal odor generally left in liquids extracted by

means of ether. I don't think that is due to ether, but something in the ether which has this peculiar odor; some minute quantity of some foreign substance which is left behind.

15 X Q. Did the facts observed by you, as stated in your direct examination, bear any evidence to your mind that the concentrate which you examined had ever existed in the form of what has been termed a froth or scum?

A. There were certain features which I noticed which are characteristic of material thus obtained, as a froth or scum. The first sample of material which I ever examined in connection with this subject was a sample of froth which was collected by Mr. Nutter. He put this froth into a bottle, sealed it up, sent it to Mr. Williams, and I opened it, so I had an opportunity to examine this sample of froth in its original condition, and its characteristics are precisely those of the material that was contained in the bag which has been introduced today as an exhibit. It was extremely fine powder, what I should think would be called slime in metallurgical language. It contained a small percentage of water, and it contained a still smaller percentage of oil. The water and oil were sufficient to cause the particles to adhere to each other to a greater or less degree, which I think would not have been the case if the material had not been a froth or scum.

16 X Q. In what manner was the oil distributed through the mass of concentrate which was brought from Bartlesville in regard to which you have testified?

A. It was evidently uniformly distributed, for, when I examined it originally, no part of it seemed to appear differently from any other part of it; that is to say, there was no evidence of unequal distribution. It seemed to be perfectly uniform.

17 X Q. Was the oil present in particles separate from the concentrate or was it attached to the particles of concentrate?

A. There were no oil particles visible; there was nothing to be seen but particles of mineral, and for that reason I think the oil was distributed uniformly over each particle of mineral.

18 X Q. You have referred to certain characteristics of this concentrate which incline you to the belief that the concentrate
5577 once existed in the form of a froth or scum. Is this disposition of the oil as a coating over the concentrate particles one of those characteristics that have led you to the belief that this concentrate was floated as a froth or scum?

A. I concluded that it was a froth or scum because I could not discover any difference in its appearance from the sample froth which Mr. Nutter has testified that he took from the top of a spitzkasten himself. Of course, it was impossible for me to determine whether each particle of mineral in this bag sample had a coating of oil upon it. It would be impossible to ascertain that by any observation that any one could make, but the uniformity in the appearance of the material led me to conclude that the oil was uniformly distributed throughout. If anyone had dropped oil upon a powder of this kind, wherever a drop came in contact with the powder the powder would become wet with oil and an oily spot would be visible to the eye, and it would be very difficult to distribute those drops of oil through the mass of powder so as to give it a uniform appearance.

19 X Q. Is it your opinion that, in the concentrate as it originally existed when brought from Bartlesville, the oil was distributed as a coating upon the particles forming the concentrate?

A. It is my opinion. I don't mean to say, of course, that the different particles which were present in this mixture of different minerals were equally coated, because it is a well known fact that, when such a finely divided mass of mineral material consisting of several minerals is exposed to oil and water, some minerals such as zinc blende, have a much greater affinity for oil than other minerals, and, consequently, in such a mixture of particles the particles of zinc blende would have a larger amount of oil than the particles of some of the gangue minerals associated with it, of course, I am not sure that there may not be some gangue minerals which have not any oil. The philosophy of using the oil is based upon this fact that zinc blende has an affinity for oil, takes it, and then when the agitation mixes the water and ore and oil together, the zinc blende particles, being coated with oil, are entangled by the air and microscopic bubbles are produced of air enclosed in a film composed of
5578 these zinc blende particles and they come to the top as a froth or a foam. Incidentally, small quantities of the gangue minerals get entangled among these bubbles of the foam and the consequence is that this foam, when it is dried and its mineral constituents determined, is always found to contain some of the gangue material. Whether those particles of gangue were actually coated with oil or not, it is impossible to determine. They might have been brought up mechanically without being oiled.

20 X Q. Does the determination which you made of the quantity of oil upon the Bartlesville concentrate lead you to any conclusion regarding the amount of oil which was originally applied to the entire ore?

A. No, it does not, because I don't know how much zinc blende there was in the ore originally and I don't know how much zinc blende was left behind in the tailings.

21 X Q. Is the particular amount of oil found upon a concentrate such as the Bartlesville concentrate one of those characteristics which you have referred to as leading you to the conclusion that the concentrate was separated as a froth or scum?

A. Yes, it is; such a small quantity of oil is characteristic of metallic minerals separated in the form of a foam from the original ore. I don't know of any other process that would leave so small a quantity of oil in the concentrate. At all events, I base my opinion on the comparison of this bag sample with the froth sample which I received from Mr. Nutter. There was an entire agreement in their characteristics.

Cross-examination closed.

Deposition closed.

[Endorsed:] Printed Transcript of Record Substituted pursuant to Order filed March 19, 1918, for incorrect copy filed November 10, 1917. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5579 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American Corporation, a Corporation, Appellees.

Upon Appeal from the United States District Court of the District of Montana.

Proceedings Had in the United States Circuit Court of Appeals for the Ninth Circuit.

5580 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American Corporation, a Corporation, Appellees.

Upon application of counsel for the appellees in the above entitled cause, and good cause therefor appearing, it is Ordered that the cause, be, and hereby is assigned for hearing at the foot of the February 1918 session of the Court, and that the time for argument of the cause be, and hereby is enlarged to one day.

(Sgd.) WM. H. HUNT,
United States Circuit Judge.

Dated San Francisco, December 19, 1917.

[Endorsed:] Order Assigning Cause for Foot of February, 1918, Calendar, etc. Filed Dec. 19, 1917. F. D. Monckton, Clerk.

5581 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Plaintiff in Error,

vs.

MINERALS SEPARATION, LIMITED, a Corporation, et al., Defendant-in Error.

Order for Withdrawal of Exhibits.

Upon the Stipulation of counsel, and good cause therefor appearing, It Is Ordered that the physical exhibits in the above entitled cause may be withdrawn.

(Sgd.) WM. H. HUNT,
United States Circuit Judge.

Dated: San Francisco, California, February 8, 1918.

Copy of Telegram.

1918, Feb. 7, P. M. 8.31.

B502D 66 NL.
Co New York NY 7.

2230.

F. D. Monckton, Clerk United States Circuit Court of Appeals, San Francisco, Calif., Post Office Bldg:

In case Butte Superior versus Minerals Separation Thomas F. Sheridan defendant's counsel and I have agreed that court may enter order for delivery now of physical exhibits to representatives of respective parties to be returned to the custody of the court at the hearing and Mr. Sheridan will telegraph to that effect stop A. Howard Higgins hereby designated as representative of plaintiffs to received these exhibits.

HENRY D. WILLIAMS.

Copy of Telegram.

57COSP 58 NL. 3 Extra.
Co New York Feb. 7 1918.

Hon. F. T. Monckton, Clerk U. S. Circuit Court of Appeals,
5582 Federal Bldg., San Francisco:

In the appeal of Butte versus Minerals Separation et al. Mr. Williams and myself as counsel for respective parties have agreed to

have a stipulation entered permitting either party to withdraw physical exhibits for purposes of preparing demonstrations for the trial appellant is perfectly willing that such a stipulation shall be entered by the court.

THOMAS F. SHERIDAN,
Counsel for Appellant.

405 AM. 8

[Endorsed:] Order for Withdrawal of Exhibits. Filed Feb. 8, 1918. F. D. Monckton, Clerk.

5583 At a stated Term, to-wit: the October Term, A. D. 1917, of the United States Circuit Court of Appeals for the Ninth Circuit, Held in the Court-room thereof, in the City and County of San Francisco, in the State of California, on Friday, the Eighth Day of March, in the year of our Lord One Thousand Nine Hundred and Eighteen.

Present: Honorable Erskine M. Ross, Circuit Judge, Presiding; Honorable William W. Morrow, Circuit Judge; Honorable William H. Hunt, Circuit Judge.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, etc., Appellant,

vs.

MINERALS SEPARATION, LIMITED, et al., Appellees.

Order of Submission.

Ordered appeal in the above-entitled cause argued by Messrs. J. Edgar Bull and Frederick P. Fish, counsel for the appellant, and by Messrs. Henry D. Williams, William Houston Kenyon, and Lindley M. Garrison, counsel for the appellees, and submitted to the Court for consideration and decision, with leave to counsel for the appellees to print and file the arguments of counsel.

5584 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Ltd., a Corporation, Appellant,

vs.

MINERALS SEPARATION, LTD., a Corporation, et al., Appellees.

Upon application of counsel for the appellant, and good cause therefor appearing, ordered corrected copies of the printed Transcript

of Record in the above-entitled cause be, and hereby are substituted for the incorrect copies of said Transcript filed in said cause, on November 10, 1917.

(Sgd.) WM. W. MORROW,
United States Circuit Judge.

Dated: San Francisco, California, March 19, 1918.

[Endorsed:] Order Allowing Substitution for Incorrect Copies of Printed Transcript of Record. Filed March 19, 1918. F. D. Monckton, Clerk.

5585 At a stated Term, to-wit: the October Term, A. D. 1917, of the United States Circuit Court of Appeals for the Ninth Circuit, Held in the Court-room thereof, in the City and County of San Francisco, in the State of California, on Monday, the thirteenth day of May, in the year of our Lord One Thousand Nine Hundred and Eighteen.

Present: Honorable William B. Gilbert, Senior Circuit Judge, Presiding; Honorable Erskine M. Ross, Circuit Judge; Honorable William H. Hunt, Circuit Judge.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Ltd., a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation, et al., Appellees.

Order Directing Filing of Opinions and Filings and Recording of Decree.

By direction of the Honorable Erskine M. Ross and William H. Hunt, Circuit Judges, before whom, together with the Honorable William W. Morrow, Circuit Judge, the cause was heard, ordered that the typewritten opinion, concurring opinion of Hunt, C. J., and opinion of Morrow, C. J., concurring in part and dissenting in part, this day rendered by the Court in the above-entitled cause be forthwith filed by the clerk, and that a Decree be filed, and recorded in the Minutes of this Court in accordance with the opinion and concurring opinion this day filed therein.

5586 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE & SUPERIOR MINING COMPANY, Appellant,

vs.

MINERALS SEPARATION, LTD., et al., Appellees.

(*Opinion U. S. Circuit Court of Appeals.*)

This is an appeal from the decree of the United States District Court for the District of Montana, sustaining Letters Patent No. 835,120, issued to Sulman, Picard and Ballot on November 6, 1906, for a process of ore concentration, and adjudging the appellant herein to have infringed the same.

The appellees, two British corporations and one domestic corporation, are the legal owners of the title to the patent in suit, and of the rights to profits and damages for infringement thereof. The appellant is a domestic corporation, doing business at Butte, Montana, where the acts of infringement complained of were committed.

The suit was commenced on October 10, 1913, and a preliminary injunction sought. At the hearing on the motion for a preliminary injunction the pleadings and proceedings in the suit of Minerals Separation, Limited, et al., v. James M. Hyde, in the United
5587 States District Court for the District of Montana, were offered and received in evidence, and are a part of the record herein. That suit was upon the same patent and the issues were substantially the same as in the present case.

The answer of the defendant set up the defense of anticipation, and denied infringement. While the cause was at issue, but before trial on the merits, the Supreme Court of the United States rendered its decision in the Hyde case (242 U. S. 261), holding Claims 1, 2, 3, 5, 6, 7, and 12 of the patent to be valid, and Claims 9, 10, and 11 to be invalid.

The plaintiffs filed a supplemental and amended bill on May 1, 1917, during the trial of the case on the merits, pleading a disclaimer filed by them on March 28, 1917, and charging continued infringement of Claims 9, 10, and 11 of the patent, as limited by said disclaimer, and of the remaining claims.

To the plaintiffs' supplemental and amended bill of complaint defendant filed its answer on May 4, 1917, denying infringement and the validity of the patent by reason of lack of novelty and invention; alleged, further, that the patent had become wholly void and invalid by reason of the unreasonable neglect and delay of the plaintiffs to file a proper or any disclaimer in writing to Claims 9, 10, and 11, held to be invalid by the Supreme Court in the Hyde case; alleged, also, an estoppel against the claim of infringement by the use by the defendant of an amount of oil exceeding five-tenths on one per cent on the weight of the ore, basing this defense upon a statement made

by one of plaintiffs' counsel in the Supreme Court of the United States in the Hyde case, that the invention described in the
5588 patent was not reached or practiced until the amount of oil fell to or below five-tenths of one per cent on the weight of ore treated by the process.

Upon the issues thus presented voluminous testimony was taken upon all the questions involved, which, as stated, were substantially the issues in the Hyde case, restated and reconsidered by the lower court in the present case.

The court thereupon entered a decree in favor of the plaintiffs, in accordance with the conclusions of the opinion, holding that the plaintiffs were the owners of the patent in suit; that the processes employed by the defendant both before and after the filing of the bill of complaint, to and including January 7, 1917, embodied the invention of the patent and infringed Claims 1, 2, 3, 5, 6, 7, and 12 thereof, and Claims 9, 10, and 11, as limited by said disclaimer; and that the processes employed by the defendant from the 7th day of January, 1917, down to and through the time of the trial, embodied the invention of the patent and infringed Claims 1, 2, 3, and 12 thereof, and Claims 9, 10, and 11, as limited by the said disclaimer. The decree granted a permanent injunction against the further use of such process by defendant, and directed that an accounting be had for the assessment of damages accruing from such use. From that decree the defendant has appealed to this court.

Mr. Henry D. Williams, New York, N. Y., Mr. Lindley M. Garrison, New York, N. Y., Mr. William Houston Kenyon, New York, N. Y., and Mr. Odell W. McConnell, Helena, Montana,
5589 Solicitors and of Counsel for Complainants and Appellees.

Mr. Thomas F. Sheridan, Chicago, Illinois, Mr. J. Edgar Bull, New York, N. Y., Mr. J. Bruce Kremer, Butte, Montana, Mr. L. P. Sanders, Butte, Montana, and Mr. Alf. C. Kremer, Butte, Montana, Solicitors and of counsel for Defendant and Appellant.

Before Ross, Morrow and Hunt, Circuit Judges.

Ross, *Circuit Judge:*

Notwithstanding the strenuous contentions on both sides of this litigation, the very elaborate preparations, and able arguments of many distinguished counsel, we can but regard the case as a very plain one.

To start with, the law is too well established to require discussion or the citation of authorities, that the patentee's rights under a patent are governed and limited by its valid claims—its specifications being referred to only as illustrative of the true meaning of the claims. It is equally well settled law that the mere result of an invention is not patentable; nor is froth, or scum, or pine oil, or any other kind of oil, or oleic acid, patentable as such.

In their specifications the patentees of the patent in suit
5590 declare that their invention "relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like, from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue"; but of the claims of their patent adjudged by the court below to have been infringed by the appellant, not one specifies any particular kind of oil, although the fifth and sixth specify as one of their constituents "a small proportion of oleic acid (which is an acid existing in most fats in combination with glycoral), amounting to 0.02-0.5 per cent on the ore." And we do not understand it to be contended that the appellant uses any oleic acid in its process.

It is not denied that at the time of the invention in question the affinity of oil for the metalliferous portion of powdered ore, when mixed with water, was well known, as well as the further fact that the agitation of such a mixture with, as well as without, the addition of acid, would carry the metalliferous portions to the surface of the mixture and the gangue to the bottom; certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this court when this patent was last under consideration here and when the whole patent was by this court held void as lacking invention (214 Fed. 100).

That judgment was, it is true, reversed by the Supreme Court (242 U. S. 261). In doing so, however, the Supreme Court held invalid claims 9, 10, and 11 of the patent, each of which claims was for "a small quantity of oil." So that it is plain the appellees are not entitled to be protected in the use of "a small quantity
5591 of oil" of any kind, which, as is obvious, is a wholly indefinite quantity.

In holding claims Nos. 1, 2, 3, 5, 6, 7 and 12 of the patent valid to the extent that it did, the Supreme Court, after pointing out in its opinion that there were many investigators at work in the field to which the process in suit related when the patentees came into it, and that it was while engaged in study of prior kindred processes that their discovery was made, said:

"While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,' (the former patents having used so much oil as to make its cost prohibitive—our observation) (The Barbed Wire Patent, 143 U. S. 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent on the ore.'"

Amounting to a fraction of one per cent on the ore is very far from saying amounting to every fraction of one per cent on the ore; a fraction is one thing, every fraction is a very different thing. It

is obvious, we think, that if the Supreme Court had meant to extend the scope of claims 1, 2, 3, 5, 6, 7, and 12 of the patent to one per cent of oil on the ore, as is here contended by the appellees, it would not have said anything about any fraction of one per cent—certainly there would have been no necessity for doing so, and certainly the use of such specific language as it employed without a pur-
5592 pose cannot be justly imputed to that great tribunal.

That the "critical proportions" "amounting to a fraction of one per cent on the ore," so protected by the Supreme Court in its decision, does not include every fraction of one per cent on the ore is, we think, very clearly shown by the same opinion where, after describing the prior state of the art, the court said:

"Into this field of investigation at this state of its development came the patentees of the patent in suit. They were experienced metallurgists of London, of inventive genius and with financial resources, and they entered upon an investigation of the processes of oil concentration of ores which was continued through several years, and consisted of a very extended series of experiments in which the quantities of oil, of water and of acid used and the extent and character of the agitation of the mass under treatment resorted to, were varied to an almost unparalleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effect on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that
5593 the production of this froth reached its maximum when about one-tenth of one per cent or slightly less 'on the ore' of oleic acid was used. This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface. The extent of the agitation of the mass had been increased as the experiments proceeded until the 'series of Gabbett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,100 revolutions per minute.'

A careful consideration of the record in this case convinces us that the facts with respect to the process of the patent in suit are not overstated by the plaintiffs' witness, Adolf Liebman, an expert of learning and experience, when he says in substance: 'The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before. The minerals are obtained in a froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals imbedded in such manner that they form a complete
5594 surface all over the bubble. A remarkable fact with regard to this froth is that, although the very slight and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for twenty-four hours without any change having taken place. The simplicity of the operation, as compared with the prior attempts, is startling. All that has to be done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from two and one-half to ten minutes and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore.' It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical."

Nothing, it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court, than that it did not intend to extend the monoply of the patent in suit to the use of one
5595 per cent of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellee "experimenters" only rose to the dignity of invention when they ascertained that the desired results could be and were obtained by the use of five-tenths (½) of one per cent of oil on the ore, with still better results as the quantity was reduced, to the vanishing point at less than one-tenth of one per cent. The quantity of oil that gave birth to the invention—five-tenths (½) of one per cent on the ore (at which point no more granulation exists)—to the lesser and extreme limit of the minute quantity (less than one-tenth of one per cent)—at which the desired result ceases, are the "critical proportions" "amounting to *a* (italic ours) fraction of one per cent on the ore," to which the appellees' patent is "confined" by the Supreme Court, as we understand its opinion.

And that is just what appears from the present record was the contention of the present appellees before the Supreme Court on the argument of their appeal from the judgment of this court holding that there was no invention in what they did. For it is undisputed that on the argument of that appeal this colloquy occurred between two of the Justices and two of the attorneys for the then appellants and the present appellees:

"Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.

"Mr. Kenyon: At about one-half of one per cent of oil.

"Mr. Justice McReynolds: Before you got to the one half of one per cent did you have any invention?

"Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct——

5596 "Mr. Justice McReynolds: I want to know when your invention came into existence.

"Mr. Kenyon: This invention was not reached, I should say from those figures, until about 0.5, that is one-half of one per cent. of oil was reached.

"Mr. Justice McReynolds: At one per cent. you had no invention?

"Mr. Kenyon: No.

"Mr. Justice McReynolds: At one-half of one per cent. you did have invention?

"Mr. Kenyon: It began to come, remote, but it began to come. At 0.3 of one per cent. the flow vastly increased. At 0.1 of one per cent. the flow again vastly increased.

"Mr. Justice McReynolds: When this flow is more than one-half of one per cent. of oil it does not infringe?

"Mr. Kenyon: It does not infringe.

"Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day, to the effect that 1.8%, or perhaps more, of oil would give the same result with increased agitation?

"Mr. Williams: Absolutely no.

"Mr. Kenyon: It would not.

"Mr. Justice Pitney: I understood him to say so yesterday, and I supposed there was something in the record to justify it.

"Mr. Kenyon: Nothing; that will be a part of my argument."

It results from the views above expressed and from the similar ones expressed in the concurring opinion of Judge Hunt, that the decree appealed from must be and is reversed and the case re-

5597 manded with directions to the court below to so modify its decree as to accord with the opinions of the majority of this Court—the appellant to recover its costs on this appeal.

[Endorsed:] Opinion. Filed May 13, 1918. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5598 In the United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE & SUPERIOR MINING COMPANY, Appellant,

vs.

MINERALS SEPARATION, LTD., et al., Appellees.

HUNT, *Judge*, concurring:

I will briefly state the ground upon which my concurrence rests:

The Supreme Court in sustaining the claims carefully noted those which were limited to a fraction of one per cent, and the decision explicitly confined the patent to the results obtained by the use of oil within the proportions often described in the testimony and in the claims.

Claims 1, 2 and 3 use the language, "amounting to a fraction of one per cent on the ore."

Claims 5, 6 and 7 express amounts, percentages on the ore.

Claim 12 uses the words of limitation, "amounting to a fraction of one per cent of oil on the ore."

Claims 9, 10 and 11 make no reference to a fraction of one per cent, but do contain the words, "a small quantity of oil."

The essence of the invention was in the use of this extremely small fraction of one per cent, and the Supreme Court, while sustaining the fraction of one per cent claims, held invalid the small
5599 quantity claims, 9, 10, 11, because they were too broad. No monopoly could be given on the use of a small quantity of oil for that was old. It was new, however, to avoid the use of larger quantities. The patent must be confined to the use of critical proportions.

Now, keeping in mind that by the decision the Court has limited the invention to the critical proportions often described by the testimony and in the claims, we naturally ask: What are the critical proportions described in the specifications? Page 1, line 79, of the specification says: To this is added a very small proportion of oleic acid (say from 0.02 per cent to 0.5 per cent on the weight of the ore); and on line 96 we have: "The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under 0.1 per cent of the ore, but this proportion has been found suitable and economical." We thus have given to us one-half of one per cent or less as the critical proportion described—preferably one-tenth of one per cent is to be used.

We also ask: What is the evidence wherein there is often described the "critical proportion?" A summary of it is that it is very nearly one-tenth of one per cent or two-tenths of one per cent as may be required for particular ore. All through the evidence it appears that minute and critical amounts of oil are to be used as necessary to

make the process successful. From one pound of oil to the ton of ore (five hundredths of one per cent) to four pounds per ton (two tenths of one per cent) were the limits in practical work as stated by witnesses.

Again, when counsel had the colloquy (quoted in the
5600 opinion of Judge Ross) with the Supreme Court, the guiding thought evident in the mind of the inquiring Justices was to stamp precision upon the point when invention in the process began to appear. With apparent definite purpose of meeting the interrogatories plaintiff told the court that "invention" began to come when in the descending uses of percentages of oil as small a quantity as five-tenths of one per cent was used, and was first present when three and two-tenths of one per cent was used. Of course, a Court should cautiously consider a response often quickly made by counsel in answer to questions put from the bench lest an injustice may follow by attaching undue weight to an isolated argumentative answer. But in this matter we are earnestly trying to gather the scope and accurate meaning of the expressed thought of the Court. We may therefore refer to the fact that the exact position of the plaintiff as to the invention was called for not once but twice, not generally nor indirectly, but positively, simply and unequivocally. Hence, in the controversy as to the true interpretation of the opinion the questions put and answers given may be fairly resorted to, not as conclusive at all but as aids toward a better understanding of the statement of the limitations of the claims of the patent and of the definition of the invention included in its language.

Nor do I think there is ground for saying that discrimination was had between known oils—whether vegetable, mineral or animal. To oily liquids which have a "preferential affinity to metalliferous matter" must the plaintiffs be held, and in using kerosene or fuel oil defendants are but employing oils which the patents au-
5601 thorize the use of; and when defendants use proportions beyond the critical ones of oil, not oleic acid, but other oils, they are not infringing. Oils doubtless vary in being adaptable for use. Some will probably secure more froth than others, and oil formulæ may in their ingredients depend upon the particular ore to be treated and upon the economic relationship to the problem under solution. But the froth developed in using the minute quantities of oil is, I think, essentially of a character like the froth shown when different quantities of oil are used—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this.

In the Cattermole process the froth was held to be distinguishable from the froth produced in the patented process of the critical proportion of oil by the fact that certain remarkable and great results come from the use of the critical proportion which were not obtained when the quantity used in the Cattermole process was employed.

By using the critical proportion of oil as defined, patentees get the maximum froth. They have discovered a process—not a

froth—and the process is limited to the use of oil in the specified critical proportion.

The sequel of these views is that inasmuch as defendants keep out of the limits made for the plaintiff by the decision of the Supreme Court by using more than the critical proportion, they do not use plaintiff's process.

[Endorsed:] Concurring Opinion of Hunt, C. J. Filed May 13, 1918. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5602 In the United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

MINERALS SEPARATION, LTD., et al., Plaintiff-, Appellees,

vs.

BUTTE & SUPERIOR MINING COMPANY, Defendant, Appellants.

(*Opinion of Morrow, C. J.*)

MORROW, *Circuit Judge,* concurring in part and dissenting in part:

I concur in the opinion of the majority of the Court that the decree should be reversed, but I do not concur in the direction that the bill be dismissed. I am of opinion that the use of an oil or oily liquid in defendant's separation process in a quantity not "amounting to more than a fraction of one per cent. on the ore" is within the express terms of Claims 1, 2, 3 and 12 of Plaintiffs' patent, and is an infringement of such patent. But I am of opinion that the use of oil or oily liquid in a quantity amounting to more than a fraction of one per cent. on the ore is not within the terms of Claims 1, 2, 3 and 12 and is therefore not an infringement upon Plaintiffs' process and that a decree should be entered accordingly.

5603 The direction of the Supreme Court in Mineral- Separation, Ltd., vs. Hyde, 242 U. S. 261, is that:

"the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as critical proportions, amounting to a fraction of one per cent. on the ore".

The term critical proportions is not used in the claims of the patent, but such proportions were described in the testimony in the Hyde case as the application of a small but exact quantity of oil to different ores and always within the range of treatment of "a fraction of one per cent. on the ore", never to the treatment of different ores within the range of "one half of one per cent." except in the use of oleic acid and that upon certain ores such as Broken Hill ores. The ap-

plication of the term "critical proportions" in the use of oil on ores generally within a range of "one half of one per cent" was discovered by counsel for appellant in this case and so far as appears from the record was revealed to the public for the first time in this Court.

The colloquy between Mr. Justice McReynolds and Mr. Kenyon, Counsel for appellant in the Supreme Court in the Hyde case referred to by Judge Ross in his opinion related to the use of Oleic acid on Broken Hill ores concerning which I do not understand that there is any controversy. I think the direction of the Supreme Court that

"the patent must be confined to the results obtained by the use of oil within the proportions * * * amounting to a fraction of one per cent. on the ore"

means just what it says and that within such proportions the process described in the patent is held by the Supreme Court to be a valid discovery protected by the Specifications and Claims numbered 1, 2, 3 and 12. The Supreme Court does not say that the patent must be confined to the Oleic acid claims (Claims 5, 6 and 7) nor does it say that the other claims of the patent must be confined to the use of oil in the fraction mentioned in those claims. Had the
5604 Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in Claims 5, 6 and 7. For what purpose does the Court hold Claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions "amounting to a fraction of one per cent. on the ore" that is to say upon ores generally.

The Specifications mentioned the fact that the ores were not all alike and that different ores may require the use of different proportions of oily material in order to secure the desired separation of metalliferous matter from the gangue by the production of a froth. The Supreme Court commenting upon this variation in the requirements of the process said:

"Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows".

The use of oleic acid on Broken Hill ore was the oil and the ore of the discovery, and the proportion of the oil used is described in

Claims 5, 6 and 7, but how about the use of other oils on other than Broken Hill ores? The proportions required for oleic acid on Broken Hill ores had been determined by actual tests but other oils and other ores had not been fully tested and the application of the process might require a different proportion of oily material
5605 upon a different class of ores. To meet such a contingency, Claims 1, 2, 3 and 12 call for the use of an oil or oily liquid "amounting to the fraction of one per cent. on the ore". Furthermore, in declaring claims 9, 10 and 11 invalid, the Supreme Court clearly did so because such claims were not confined to the use of oil "amounting to a fraction of one per cent. on the ore." The claim was for the use of "a small quantity of oil", which might be a quantity more than "a fraction of one per cent. on the ore".

The validity of the other claims in controversy having been sustained upon their limitation of the use of oil within the proportion "amounting to a fraction of one per cent. on the ore," it followed that Claims 9, 10, and 11 were held invalid because they were not so confined, and were therefore too broad. The disclaimer accordingly disclaims from Claims 9, 10, and 11 of the patent "any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore." Such language was strictly in accordance with the decision of the Supreme Court and I think, a sufficient rejection of the excess from the invention claimed, leaving the patent in the form limited by the opinion of the Supreme Court.

With respect to the objection that the disclaimer was not filed in time, the mandate of the Supreme Court became effective January 13, 1917, decreeing the patent to be invalid as to Claims 9,
5606 · 10 and 11, but valid as to the other claims in issue. On March 28, 1917, the plaintiffs filed their disclaimer, some time before the right to petition for a rehearing in the Supreme Court had expired. Considering the importance of the procedure to be followed, the residence of the patentees in another country and the consequent delay in communication, the date of filing was not unreasonably delayed.

[Endorsed:] Opinion of Morrow, C. J., concurring in part and dissenting in part. Filed May 13, 1918, F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5607 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American Corporation, a Corporation, Appellees.

Decree U. S. Circuit Court of Appeals.

Appeal from the District Court of the United States for the District of Montana,

This Cause came on to be heard on the Transcript of the Record from the District Court of the United States for the District of Montana and was duly submitted:

On Consideration Whereof, It is now here ordered, adjudged, and decreed by this Court, that the decree of the said District Court in this cause be, and hereby is, reversed, with costs in favor of the appellant and against the appellees, and that this cause be, and hereby is remanded with directions to the said District Court to so modify its decree as to accord with the opinions of the majority of this Court.

It is further ordered, adjudged and decreed by this Court, that the appellant recover against the appellees for its costs herein expended, and have execution therefor.

[Endorsed:] Decree. Filed and Entered May 13, 1918, as Amended Pursuant to Order Filed and Entered May 20, 1918. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5608 At a stated Term, to-wit, the October Term, A. D. 1917, of the United States Circuit Court of Appeals for the Ninth Circuit, held in the Court-Room thereof, in the City and County of San Francisco, in the State of California, on Monday, the twentieth day of May, in the year of our Lord One Thousand Nine Hundred and Eighteen.

Present: Honorable William B. Gilbert, Senior Circuit Judge, Presiding; Honorable Erskine M. Ross, Circuit Judge; Honorable William H. Hunt, Circuit Judge.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American Corporation, a Corporation, Appellees.

Order Modifying Decree.

ROSS, *Circuit Judge;* HUNT, *Circuit Judge,* concurring; MORROW, *Circuit Judge,* concurring in the reversal but dissenting from the modification of the decree herein directed and as to costs:

Understanding from the presentation of this case that the real and pivotal question for the decision of this Court was whether or not under the decision of the Supreme Court in the case of Minerals Separation, Ltd. v. Hyde, 242 U. S. 261, the use of any oil by the appellant in quantity of one per cent, or less on the ore, constituted an infringement of the appellees' patent, and that the fact was undisputed that the appellant had not used as little as one half of one per cent. of oil in its process, in reversing the judgment of the court below we directed that court to dismiss the bill at the complainant's cost. Inasmuch, however, as it appears and is admitted that prior to and including January 7, 1917, the appellant did use in its
5609 process oil in quantities of one-half of one per cent. and less, thereby in those instances infringing the patent of the appellees,

It is hereby ordered that the judgment of this Court herein rendered and entered May 13, 1918, be and hereby is corrected so as to read as follows:

The decree appealed from must be and is reversed and the case remanded with directions to the court below to so modify its decree as to accord with the opinions of the majority of this Court—the appellant to recover its costs on this appeal.

5610 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American Corporation, a Corporation, Appellees.

Certificate of Clerk U. S. Circuit Court of Appeals to Printed Transcript of Record and Proceedings.

I, Frank D. Monckton, as Clerk of the United States Circuit Court of Appeals for the Ninth Circuit, do hereby certify the foregoing two hundred and thirty pages, numbered from and including i to and including ccxxx (contained in Volume 1) and the foregoing fifty-six hundred and nine (5609) pages, numbered from and including 1 to and including 5609, marked, respectively, Volumes 2, 3, 4, 5, 6, 7, 8 and 9, and Volume 10 "Errata," said "Errata" being numbered from and including 1 to and including 54, to be a full, true and correct copy of the entire record of the above-entitled case in said Circuit Court of Appeals, as the originals thereof remain on file and appear of record in my office, excepting the original exhibits placed of record in said case.

Attest my hand and the seal of the said the United States Circuit Court of Appeals for the Ninth Circuit, at the city of San Francisco, in the State of California, this 27th day of May, A. D. 1918.

[Seal United States Circuit Court of Appeals, Ninth Circuit.]

F. D. MONCKTON, *Clerk*,
By PAUL P. O'BRIEN,
Deputy Clerk.

5611 UNITED STATES OF AMERICA, *ss:*

The President of the United States of America to the Honorable the Judges of the United States Circuit Court of Appeals for the Ninth Circuit, Greeting:

[Seal of the Supreme Court of the United States.]

Being informed that there is now pending before you a suit in which Butte and Superior Mining Company, designated as Butte and Superior Copper Company, Limited, is appellant, and Minerals Separation, Limited, Minerals Separation American Syndicate, Limited, and Minerals Separation North American, are appellees, No. 3081, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the District Court of the United States for the District of Montana, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by the said Circuit Court of Appeals and removed into the Supreme Court of the United States, do hereby command
5612 you that you send without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable Edward D. White, Chief Justice of the United States, the thirteenth day of November, in the year of our Lord one thousand nine hundred and eighteen.

JAMES D. MAHER,
Clerk of the Supreme Court of the United States.

[Endorsed:] File No. 26,685. Supreme Court of the United States, No. 599, October Term, 191-. Minerals Separation, Limited, et al. vs. Butte and Superior Mining Company et al. Writ of Certiorari. Docketed. No. 3081. United States Circuit Court of Appeals for the Ninth Circuit. Filed Nov. 25, 1918. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5613 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE & SUPERIOR MINING COMPANY, Appellant,

vs.

MINERALS SEPARATION, LIMITED; MINERALS SEPARATION AMERICAN Syndicate, Limited, and Minerals Separation North American Corporation, Appellees.

On Appeal from the United States District Court for the District of Montana.

Stipulation.

It is hereby stipulated and agreed by and between attorneys of record in the above entitled cause that the Transcript of Record now on file in the Supreme Court of the United States in the case of Minerals Separation, Ltd., et al., Petitioners, and Butte & Superior Mining Company, designated as Butte & Superior Copper Company, Ltd., No. 599, October Term, 1918, of said Supreme Court, shall stand as the Return of the judges of the United States Circuit Court of Appeals for the Ninth Circuit to the Writ of Certiorari issued out of said Supreme Court on the 13th day of November, A. D. nineteen eighteen, subject to correction if error should appear therein.

Dated November 19, 1918.

THOMAS F. SHERIDAN,
J. EDGAR BULL,
FREDERICK P. FISH,
J. BRUCE KREMER,
KURNAL R. BABBITT,
Attorneys for Appellant.
HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Attorneys for Appellees.

Endorsed: Stipulation as to Return to Writ of Certiorari. Filed Nov. 25, 1918. F. D. Monckton, Clerk, by Paul P. O'Brien, Deputy Clerk.

5614 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE & SUPERIOR MINING COMPANY, Appellant,

vs.

MINERALS SEPARATION, LIMITED; MINERALS SEPARATION AMERICAN Syndicate, Limited, and Minerals Separation North American Corporation, Appellees.

Certificate of Clerk U. S. Circuit Court of Appeals to Stipulation as to Return to Writ of Certiorari from Supreme Court U. S.

I, Frank D. Monckton, as Clerk of the United States Circuit Court of Appeals for the Ninth Circuit, do hereby certify the next preceding page to be a full, true and correct copy of a "Stipulation as to Return to Writ of Certiorari," filed in the above-entitled cause on the 25th day of November, A. D. 1918, as the original thereof remains on file and of record in my office.

Attest my hand and the seal of the United States Circuit Court of Appeals for the Ninth Circuit, at the City of San Francisco, in the State of California, this 25th day of November, A. D. 1918.

[Seal United States Circuit Court of Appeals, Ninth Circuit.]

FRANK D. MONCKTON,
Clerk,

By PAUL P. O'BRIEN,
Deputy Clerk.

5615 United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE & SUPERIOR MINING COMPANY, Appellant,

vs.

MINERALS SEPARATION, LIMITED; MINERALS SEPARATION AMERICAN Syndicate, Limited, and Minerals Separation North American Corporation, Appellees.

Return to Writ of Certiorari.

By direction of the Honorable the Judges of the United States Circuit Court of Appeals for the Ninth Circuit, I, Frank D. Monckton, as Clerk of said Court, in obedience to the annexed writ of certiorari issued out of the Honorable the Supreme Court of the United States and addressed to the Honorable the Judges of the United

States Circuit Court of Appeals for the Ninth Circuit, commanding them to send, without delay, to the said Supreme Court the record and proceedings in the above-entitled cause, do attach to the said Writ and send to the said Supreme Court a certified copy of a "Stipulation as to Return to Writ of Certiorari," entered into by and between the attorneys of record, that the Transcript of Record now on file in said cause in the said Supreme Court shall stand as the Return to the said Writ of Certiorari, the original of which stipulation was filed in my office on the 25th day of November, A. D. 1918.

In testimony whereof, I have hereunto set my hand and affixed the seal of the United States Circuit Court of Appeals for the Ninth Circuit, at the City of San Francisco, in the State of California, this 25th day of November, A. D. 1918.

[Seal United States Circuit Court of Appeals, Ninth Circuit.]

F. D. MONCKTON,
Clerk of the United States Circuit Court of Appeals for the Ninth Circuit.
By PAUL P. O'BRIEN,
Deputy Clerk.

[Endorsed:] 599/26685.

[Endorsed:] File No. 26,685. Supreme Court U. S., October Term, 1918. Term No. 599. Minerals Separation, Ltd., et al., Petitioners, vs. Butte and Superior Mining Co. et al. Writ of Certiorari and Return. Filed December 5, 1918.

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Supreme Court of the United States.

MINERALS SEPARATION, LTD., *et al.*, Plaintiffs-Petitioners, vs. BUTTE & SUPERIOR MINING COMPANY, Defendant-Respondent.	October Term, 1918. No. 599.

BRIEF FOR DEFENDANT-RESPONDENT.

This is an action brought in the District of Montana for infringement of Letters Patent No. 835,120, for Process of Ore Concentration, issued to Sulman, Picard & Ballot, November 6, 1906.

The patent in suit is the same patent which was before this Court in *Minerals Separation* vs. *Hyde,* 242 U. S. 261.

The District Court in this case found the patent in suit infringed by the defendant when it used oil in quantities of more than 1% on the ore, as well as when it used oil in quantities of less than 0.5% on the ore (see Opinion, Vol. I, p. 93, and Decree, Vol. I, p. 102).

The Court of Appeals for the Ninth Circuit found the patent in suit infringed by the defendant when it used oil in quantities of 0.5% or less; but found it was not infringed when it used oil in quantities above 0.5%—0.5% being the largest amount of oil described in the patent as capable of yielding the desired results.

The claims in issue are 1, 2, 3, 5, 6, 7, 9, 10, 11 and 12.

Of these claims 5, 6 and 7 relate to the use of oleic acid specifically and these we call the "oleic-acid claims". It is not contended by plaintiffs that defendant has used oleic acid since December 7, 1917. With respect to claims 9, 10, 11 ~~and 12~~, which specify the use of a "small quantity" of oil, and which we call, therefore, the "small-quantity claims", an alleged disclaimer was filed on May 18, 1917 (Tr. Vol. VI, p. 2754) which is discussed *infra*, pages 101-109. The remaining claims (to wit: 1, 2, 3 and ~~8~~) specify 13 that the quantity of oil used shall be "a fraction of one per cent." and we, therefore, call them the "fraction-of-one per-cent claims."

DEFENDANTS ACTS COMPLAINED OF ARE (1) IN THE USE OF LESS THAN 0.5% OF OIL, WITH RESPECT TO WHICH DEFENDANT NOW STANDS ENJOINED; (2) THE USE OF MORE THAN 0.5% AND LESS THAN 1% OF OIL; (3) THE USE OF MORE THAN 1% OF OIL.

The decision of this Court in the Hyde case was handed down in December, 1916. Prior to January 7, 1917, the defendant used various oils (among them oleic acid) in quantities about 0.1% on the ore. Defendant admits that these operations infringed the fraction-of-one-per-cent. claims, and, so far as oleic acid was used, infringed the oleic-acid claims.

Subsequent to January 7, 1917, defendant has not used oleic acid at all, nor has it used any kind of oil in quantities as small as 0.5%. On the contrary, it has always used oils, other than oleic acid, in quantities above 0.5% on the ore, and for most of the time covered by the proofs it has used such oils in quantities above 1% on the ore (see Defendant's Exhibits Nos. 158, 161, 162, 163, Tr. Vol. VI, following page 2882).

An examination of Defendant's Exhibit No. 158 (Vol. VI, p. 2882) shows that beginning in 1913 and down to January 7, 1917, the defendant always used less than

0.5% of oil (see column under "Per Cent. added," sub-title under "Per Ton Ore to Flotation," sub-title under "Oil—Amount and Analysis"). An accounting covering this period has already been ordered by the Court of Appeals. This exhibit shows that for the week beginning January 9, 1917, the defendant used more than 1% of oil—to wit: 1.24%. It shows that during the two and one-half weeks between January 17, 1917, and February 3, 1917, defendant used more than 0.5% and less than 1% —to wit: 0.84% and 0.80%. It shows that subsequent thereto defendant always used 1% or more—to wit: 1.01% to 1.56%.*

DEFENDANT'S USE OF OIL IN QUANTITIES ABOVE 1% DOES NOT INFRINGE.

The first question is whether the use by defendant of oil in quantities above 1% on the ore infringed any valid claims of the patent in suit. We submit that this question has already been answered by this Court in the negative in its decision in the Hyde case.

The defendant in the Hyde case used the specific oil mentioned in the patent (to wit: oleic acid) and he used it in the preferred quantity mentioned in the patent (to wit: about 0.1%). There were in issue in that case not only the oleic-acid claims (5, 6 and 7) and the fraction-of-one-per-cent. claims (1, 2, 3, 9 and 12), but there were also in issue the small-quantity claims (10, 11 ~~and 12~~).

The learned District Judge in the Hyde case (207 Fed. 956) did not regard the use of a fraction of 1% of

* The total quantity of oil present in the process after February 4 is shown in the column entitled, "Per Cent. Oil in Ore and Circulating Middling Treated in Flotation." Before February 4 no record was kept of the oil in the so-called "Circulating Load," and therefore no entries in this column appear before that date. Since a "Circulating Load" was always used and always carried oil, the amount of oil actually present in all cases was somewhat greater than that indicated in the column "Per Cent. added." For an explanation of the meaning and effect of the "Circulating Load" see *infra*, page 91.

oil as of the essence of the patented process, and he, therefore, sustained not only the fraction-of-one-per-cent. claims, but he also *sustained the small-quantity claims* (9, 10 and 11). Next the patent in suit came before the District Court of Delaware in the Miami case (237 Fed. 609). In that case the claims in issue were the fraction-of-one-per-cent. claims (1 and 12) and the small-quantity claims (9, [illegible]). In that case the learned Judge held that the use of a fraction of 1% of oil was of the essence of the invention, and he, therefore, while holding the fraction-of-one-per-cent. claims valid, found that the *small-quantity claims were invalid* because broader than the invention.

Next the patent in suit came before this Court by writ of *certiorari* in the Hyde case. This Court agreed with the learned Judge in the Miami case that the use of a fraction of 1% of oil was of the essence of the invention, and to that extent disagreed with the learned District Judge in the Hyde case. Therefore, while it found the fraction-of-one-per-cent. claims to be valid, it at the same time found the *small-quantity claims to be invalid* because broader than the invention. This Court said (p. 266):

> "The prior processes which we have described required the use of so much oil that they were too expensive to be used on lean ores, to which they were intended to have their chief application and the efforts of investigators for several years prior to the discovery of the process in suit had been directed to the search for a means or method of reducing the amount of oil used, and it is clear from the record that approach was being made, slowly but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905."

(P. 268):

> "The present invention differs essentially from all previous results. It is true that oil is one of

the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before."

(P. 271):

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,' (The Barbed Wire Patent, 143 U. S. 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."

Comparing the group of claims which was sustained —to-wit, claims 1, 2, 3 and 12—with the group of claims which was condemned—to-wit, claims 9, 10 and 11—it will be seen that all the claims of both groups were limited in terms to the production of a "froth" by "agitation", and to the separation of the "froth" from the material; but that the claims which were sustained were limited in terms to the use of oil in *"a fraction* of one per cent." (*what fraction* of one per cent. was not specified), while the claims which were condemned were broad enough to cover the use of *"a small quantity"* of oil. The only difference between the claims which were sustained and those which were condemned is, therefore, that the

former were, while the latter were not, in terms limited to the use of less than one per cent. of oil on the ore.

In view of this decision, the plaintiffs filed a disclaimer which they allege limits the small-quantity claims (9, 10 and 11) so to conform with the above decision.

That the patent in suit does not cover the use of oil in quantities of 1% or more has, therefore, been squarely decided by this Court.

This Court has directly passed upon the question as to whether the patentees are entitled to a monopoly in the use of oil in larger quantities than a fraction of 1%, and it has *directly held that quantities larger than a fraction of 1% are free and open to be used by the public.*

The Court of Appeals for the Ninth Circuit has held that the patent in suit covers the use of oil in quantities up to 0.5% on the ore, and has granted an injunction against the use of such quantities and an accounting covering the period during which defendant used 0.5% or less.

When the District Court in this case held, as it did, that defendant infringed the patent in suit when it used 1% and more of oil, we think it overlooked the fact that this Court had sustained only those claims of the patent which, in terms, are limited to a fraction of 1% and had condemned as too broad those claims which were comprehensive enough to cover the use of any "small quantity" of oil. It seems to us that the learned Judge's decision in this case amounted to a reaffirmance in all respects of his decision in the Hyde case, including the errors in that decision which had already been condemned by this Court in its opinion in the Hyde case.

Defendant's Use of Oil in Quantities Between 0.5% and 1% Does Not Infringe.

The great question in this case is whether the use by defendant of oil in quantities of 0.5% and 1% infringes any valid claim of the patent in suit. We submit that this question also has already been answered in the nega-

tive by this Court's decision in the Hyde case; and this is what the Circuit Court of Appeals for the Ninth Circuit found.

The first question is, What did this Court mean in its opinion in the Hyde case when it said that "the efforts "of investigators for several years prior to the discovery "of the process in suit had been directed to the search for "a means or method of reducing the amount of oil used, "and it is clear from the record that approach was being "made, slowly, but more and more nearly to the result "which was reached by the patentees of the process in "suit in March, 1905"; and when it said that "the investi- "gations preceding were so informing that this final step "was not a long one"?

In this connection, we can best assist this Court by refreshing its recollection as to the proofs in the Hyde case concerning the quantities of oil used in prior-art processes.

PRIOR-ART PATENTS BEFORE THIS COURT IN THE HYDE CASE DESCRIBE THE USE OF OIL IN QUANTITIES RANGING BETWEEN 300% AND A LARGE FRACTION OF 1% ON THE ORE.

The prior art process using the largest quantity of oil was the Elmore bulk-oil process. The Elmore patents (No. 676,679, Tr. Vol. III, p. 1241, and No. 689,070, Vol. III, p. 1243) do not state the quantity of oil to be used, but plaintiff's witnesses Liebmann and Ballantyne, in the Hyde case, stated it was between 100% and 300% on the ore (Tr. Vol. I, p. 462; also p. 316). The smallest quantity of oil used in this process was, therefore, 100% on the ore.

The Kirby patent says, concerning the quantity of oil to be used (Tr. Vol. III, p. 1303, line 29), that excellent results are obtained with "one-fourth to three-fourths as much, by weight, as ore". The smallest quantity of oil used in this process was, therefore, 25% on the ore.

The Haynes patent says, concerning the quantity of oil to be used (Tr. Vol. II, p. 766, fourth line from bottom), that it is to be "one part of the mixture thus made [oil] to from five to nine parts of the ore". Since one part of oil to nine parts of ore is about 11% on the ore, 11% is the smallest quantity of oil used in this process.

The Everson patent contains two examples. In the first example it says (Tr. Vol. III, p. 1210, line 35): "the proportions of ore and compound [oil] being chosen with a view to producing a stiff mass after the materials have been incorporated, such proportions being, therefore, variable in different cases with this end in view". Plaintiff's expert, Dr. Liebman, in the Hyde case, translated this as directing the use of about 5% of oil on the ore (Tr. Vol. I, p. 461). This patent, therefore, describes the use of as little as 5% of oil on the ore.

The Froment patent (British patent to Lake, No. 12,778 of 1902, Tr. Vol. III, p. 1332) describes the quantity of oil to be used as a "thin layer of ordinary oil" (Tr. Vol. III, p. 1333, line 36). Plaintiff's expert, Ballantyne, in the Hyde case, interpreted this to require the use of not less than 5% of oil (Tr. Vol. I, p. 316). This patent, therefore, also requires the use of about 5% of oil on the ore.

Minerals Separation, the plaintiff, in 1903 purchased the Froment British patent above referred to, and, as part of the consideration, it was to receive from Froment certain apparatus and certain written instructions for the practice of the process (see assignment Froment to Ballot, Tr. Vol. II, p. 713). These written instructions, which were later received from Froment, are known in this case as the Froment Description and they are reproduced in the record, together with a translation of them, Vol. II, pp. 589 to 600. While this writing was not a printed publication, nor was it prior art with respect to the public in this country, nevertheless it was prior

art with respect to the patentees of the patent in suit, because they had knowledge of its contents before the invention of the patent in suit was conceived by them. The patentee Ballot, states that this Froment Description was received by him in December, 1903 (Tr. Vol. II, p. 1035, Q. 123). The patentee Picard, admits that he was familiar with its contents (Tr. Vol. II, p. 1011, x-Qs. 82 and 83). The patentee, Sulman, admits that he was familiar with the apparatus received from Froment (Vol. II, p. 961, Q. 11). Since the laws of this country require that a person to receive a valid patent must not only be the first but must be an *original* inventor (R. S. Secs. 4886, 4892, 4923), it is evident that, so far as these patentees are concerned, the Froment Description was as much a part of the state of the art as if it had been a printed publication.* This paper defines the amount of oil to be used (Tr. Vol. II, p. 597) as follows:

"1 % of oil for ore containing up to 5% of metals.
"1½% " " " " " " " 10% " "
"2 % " " " " " " " 15% " "

* Section 4886 provides that "Any person who has *invented or discovered* any new and useful art, machine" * * * "not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof" may receive a patent therefor; and Section 4892 requires that the "applicant shall make oath that he does verily believe himself to be the *original and first inventor or discoverer* of the art, machine" etc.; while Section 4923 provides that "Whenever it appears that a patentee, at the time of making his application for the patent, *believed himself to be the original and first inventor or discoverer* of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication".

A patent is valid, therefore, only for the subject-matter which is *"original"* with the patentee—that which he *"invented or discovered"*—and any knowledge actually acquired by him from another before he made the invention is prior-art as to him, although it would not be prior-art as to others who had not actually acquired the knowledge, unless the subject-matter had been put into use in this country, or had been patented or described in a printed publication in this or any foreign country.

The smallest amount of oil used in this process was, therefore, 1% on the ore.

The Cattermole patent (No. 777,273, Tr. Vol. III, p. 1282, line 72) describes the use of "an amount of oil varying from four per cent. to six per cent. of the *weight of metalliferous mineral matter present in the ore.*" The amount of oil, therefore, was to be determined, not by the amount of ore present, but by the amount of metalliferous matter which was contained in the ore. This Cattermole process was developed by Minerals Separation in connection with the treatment of Broken Hill tailings. Plaintiff's witness Professor Chandler, in the Hyde case, states that Broken Hill tailings contained about 30% metalliferous matter, and that, therefore, with such ore, 4% on the metalliferous matter would equal 1.2% on the ore (Tr. Vol. I, p. 529, Vol. I, p. 541, Q. 125). The Butte & Superior ore (defendant's ore in this case) averages under 15% zinc (see Exhibit No. 158, Tr. Vol. VI, opposite page 2882, second column). Since the zinc present is in the form of a sulphide—that is, is combined with sulphur—the "metalliferous matter" in such an ore is about 22% (Tr. Vol. IV, p. 1910, Qs. 91 and 92). 4% of oil on the metalliferous matter on the Butte & Superior ore would, therefore, be 0.88% on the ore—that is, 4% of 22%. This Cattermole patent, therefore, describes the use of as little as 1.2% of oil on the ore for Broken Hill tailings (the specific ore in connection with which the process was practiced by Minerals Separation), and as little as 0.88% on such ore as the defendant in this case is treating.

Finally we come to the patent in suit. This describes the use of as little oil as 0.02% on the ore (Tr. Vol. II, p. 565, line 81). The largest amount mentioned is 0.5% on the ore (Tr. Vol. II, p. 565, line 81) and the preferred amount is about 0.1% on the ore (Tr. Vol. II, p. 565, lines 96 to 101).

It is particularly to be noted in this connection that

the patent in suit in the introductory clause in terms refers to the Cattermole patents and to the fact that "an amount of oil varying from four per cent. to six per cent. of the *weight of metalliferous* matter present" is described therein. Continuing, it says, "We have found that if the proportion of oily substance be *considerably reduced,*" etc. (Tr. Vol. II, p. 565, lines 16 to 29). As already shown, *applied to defendants ore,* this can only mean a "*considerable reduction*" *below 0.88%.*

RÉSUMÉ.

Elmore: 100% to 300% on the ore.
Kirby: as little as 25% on the ore.
Haynes: as little as 11% on the ore.
Everson: as little as 5% on the ore.
Froment patent: as little as 5% on the ore.
Froment Description: as little as 1% on the ore.
Cattermole: as little as 4% on the mineral contents, which equals 1.2% on the ore with Broken Hill tailings and 0.88% on the ore with defendant's ore.
Patent in suit: as little as 0.02% on the ore; about 0.1% on the ore being the preferred quantity and 0.5% on the ore being the largest quantity mentioned.

It is respectfully submitted, therefore, that when this Court said in its opinion in the Hyde case that the "step was not a long one", it had in mind the fact that the Froment Description recommended the use of as little as 1% on the ore, and that the Cattermole proportions applied to Broken Hill tailings would result in the use of as little as 1.2% on the ore, and as applied to defendant's ore would result in the use ot as little of 0.88% on the ore. The latter amount (i. e., 0.88%) is "*a* fraction of one per cent." but it is not *the* "fraction of one per

cent." described in the specifications of the patent in suit, which is not above 0.5% on the ore.*

In view of the prior art as above set forth which was in the Hyde case, it is perfectly plain what this Court meant in the Hyde case when it said (p. 266):

> "The prior processes which we have described required the use of so much oil that they were too expensive to be used on lean ores, to which they were intended to have their chief application and the efforts of investigators for several years prior to the discovery of the process in suit had been directed to the search for a means or method of *reducing the amount of oil used*, and it is clear from the record that *approach was being made*, slowly but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905."

(p. 268):

> "The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities *much smaller than was ever heard of*, and it produces a result never obtained, before."

(p. 271):

> "While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field

* In addition to the above prior art, all of which was before this Court in the Hyde case, we have in this case the California Journal of Technology of November 1903 (Tr. Vol. VI, pp. 2755 to 2764) which is a publication issued by the students of the University of California. In this publication experiments in the production of the "foam effect" are described employing from 2.1% to 8.9% of oil on the ore. These experiments are numbered 4, 5 and 6 in the table on page 2759 of Vol. VI, and they are explained by Dr. Sadtler on page 1643, Q. 44 of Vol. III. This publication, therefore, describes the use of oil in quantities as small as 2.1% on the ore. This publication is discussed *infra*, page 21.

> to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,' (The Barbed Wire Patent, 143 U. S. 275), yet the investigations preceding were so informing that this *final step was not a long one* and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."

We have seen that Cattermole proportions applied to defendant's ore require the use of only 0.88% of oil on the ore. What then was the "short step" which this Court found the patentees had taken? What did this Court mean when it said that the "patent must be confined to the results obtained by the use of oil within the proportions *often described in the testimony and in the claims as 'critical proportions'* amounting to a fraction of one per cent. on the ore"?

PLAINTIFFS' WITNESSES AND PLAINTIFFS' COUNSEL TOLD THIS COURT IN THE HYDE CASE THAT THE "CRITICAL" QUANTITY OF OIL WAS ALWAYS LESS THAN 0.5% ON THE ORE.

As the facts were presented to this Court by plaintiff's counsel in the Hyde case, even so small a quantity of oil as 0.88% on the ore would not accomplish the desired result. Plaintiff's counsel in the Hyde case said that the quantity of oil used must be in the neighborhood of 0.1%,

which is the preferred quantity described in the example of the patent. Indeed, they said that the largest quantity that had ever been found useful in practice with any ore, or with any oil, was 0.2%. Thus they said in their reply brief before this Court (p. 6):

> "It is the astonishing fact that, so far as the record here shows, with every ore the world over to which the process has been applied and with all the varying conditions of use, the *largest quantity ever used has been 4 pounds to the long ton (i. e., less than 2/10ths of one per cent.)*, and that the smallest quantity has been 9/10th of a pound per long ton of ore (*i. e.*, less than ½ of 1/10th of 1 per cent.)."

As we have seen, this Court in the Hyde case limited the invention to the *"proportion often described in the testimony"* as critical. What were the proportions often described in the testimony of the Hyde case as critical? This testimony was summarized by plaintiff's counsel in their main brief in the Hyde case. Beginning on the very first page of that brief they said:

> "The distinctive feature of the invention patented is the employment of air bubbles in co-action with a *minute and critical* amount of oil in a mixture of ground ore and water so as to produce upon the surface of the water a froth containing substantially all of the metallic particles which can be easily flowed off or removed.
>
> "This process was never used before. This result was never obtained before. The process is dependent upon the use of oil in a *minute and critical* amount and thorough aeration. If *more* oil is used, you do not operate the process, and you do not get the result. So also if *less* oil is used the process is not operated and the result is not obtained. By using *other and greater* quantities of oil you operate a different process and you obtain wholly different results. That the *critical* amount of oil characterizing the process is a *minute*

amount of oil (varying slightly with different ores and different oils) is merely a fortuitous circumstance. Nevertheless the process is *dependent upon such definite minute* amount of oil."

On page 10 they said:

"It is also known that the process is *destroyed* if the amount of oil is increased over the *minute* proportions characteristic of the process.

"This latter fact, namely, that the process is in each instance conditioned on the use of *definite and astonishingly minute* oil proportions (varying slightly with different ores and different oils), is one of the important facts that is clearly proved in the evidence in behalf both of complainants and of defendant which the Circuit Court of Appeals overlooked or disregarded."

On page 11 they said:

"From the above evidence of defendant and other abundant evidence in the record it appears that for a given ore and a given oil, a *definite minute* amount of oil is *essential* to the carrying on of the process; that *any substantial increase or diminution of this critical quantity* of oil impairs or destroys the process; and that the production of the peculiar mineral froth characteristic of the process is recognizable by metallurgists skilled in this new art as an infallible indication of the use of the process.

* * * * * *

"The history of the art demonstrates that with the conjoint use of air and oil, flotation-concentration is wholly impracticable unless the *minute* quantity of oil *characterizing* the process in suit is used."

On page 36 of their reply brief they said:

"It consisted in a distinct and novel mode of operation—in the evoking of distinct and hitherto unused principles of action which could be brought

> into being and made operative only by the use of the *minute amount of oil prescribed* and by the method set forth."

Plaintiff's counsel, Mr. Kenyon, said in his oral argument before this court in the Hyde case (printed report of arguments, p. 91):

> "It is apparent now that the inventors in their minute one-tenth of one per cent. oil frothing reagent were really invoking a characteristic and a power of oil in an ore concentration process that *develops only in that relatively microscopic quantity*, and which is defeated and disappears when that minute quantity is *even slightly* exceeded, a characteristic and a power of oil which had not existed in the prior oil concentration processes of the art, which had never been utilized by anybody for ore concentration, and the very existence of which had not been known or suspected."

Plaintiff's counsel, Mr. Williams, said in his oral argument before this Court in the Hyde case (printed report of arguments, p. 12):

> "The amount of oil that we use is generally one-tenth of one per cent. on the ore; two pounds of oil to the short ton of ore. Every ore presents its own problem, but for a given ore and a given oil there is a certain *critical* factor. The variations in that factor in practice have been from a *trifle less than one pound of oil to the long ton in the case of the rich ores of Australia to four pounds of oil to the long ton in the case of a lean copper ore at the Braden mines in Chile.** Those are the variations of different oils and different ores, and because of those *minute variations* you have the impossibility of saying that this process always uses just so much; but given any ore and given any oil, the evidence shows that *if you add another pound of oil* your metal particles commence to stick to-

* $\frac{1}{20}$ lb. equals 0.045%; 4 lbs. equals 0.2%.

gether and commence to fall down in granules, and you get into the Cattermole sinking sphere, whereas, on the other hand, if you *diminish* it, you cease to have that selective action which is essential; you do not get any float in particular and you have gangue in it; so that it is critical for a given oil and a given ore, but it has variations."

Not only were these statements repeated over and over again, but they were emphasized in a colloquy between the Court and counsel for plaintiffs, as follows (Tr. Vol. VI, pp. 2948-2949, and printed copy oral arguments, p. 85):

"MR. JUSTICE MCREYNOLDS: I would like to ask you when in this process of reducing oil your invention came into existence?

"MR. KENYON: At *about one-half of one per cent.* of oil.

"MR. JUSTICE MCREYNOLDS: Before you got to the one-half of one per cent. did you have any invention?

"MR. KENYON: We were passing from the region of Cattermole, which was a distant——

"MR. JUSTICE MCREYNOLDS: *I want to know when your invention came into existence?*

"MR. KENYON: This invention was *not reached*, I should say, from those figures, until *about .5, that is, one-half of one per cent. of oil was reached.*

"MR. JUSTICE MCREYNOLDS: At one per cent. you had no invention?

"MR. KENYON: *No.*

"MR. JUSTICE MCREYNOLDS: At one-half of one per cent. you did have invention?

"MR. KENYON: *It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.*

"MR. JUSTICE MCREYNOLDS: WHEN THIS FLOAT HAS MORE THAN ONE-HALF OF ONE PER CENT. OF OIL IT DOES NOT INFRINGE?

"MR. KENYON: IT DOES NOT INFRINGE.

"MR. JUSTICE PITNEY: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation.

"MR. WILLIAMS: *Absolutely no.*

"MR. KENYON: *It would not.*

"MR. JUSTICE PITNEY: I understood him to say so yesterday, and I supposed there was something in the record to justify it.

"MR. KENYON: *Nothing.* That will be a part of my argument."

In the Court below Mr. Kenyon said that nothing was further from his intention, in his answers to Mr. Justice McReynolds' inquiries, than to limit the claims to 0.5% of oil. In view of the testimony and plaintiffs' brief and arguments, we do not see how he could have answered the questions otherwise than he did. But Mr. Kenyon's intentions are immaterial. What we are doing here is to refresh the mind of this Court as to the facts and arguments before it which were the basis of its decision and gave rise to the use of the language above quoted.

Turning to the record in the Hyde case, it will be found that *every witness examined on this point testified that quantities of oil above 0.5% (the maximum amount specified in the patent) were not capable of producing the desired results.*

Plaintiffs' expert witness Dr. Chandler said in answer to x-Q. 42 (Tr. Vol. I, p. 197):

"The inventors simply state, referring to the Cattermole patent which has just been previously discussed, that four to six per cent. of the weight of metalliferous matter present is employed, that they have found that if the proportion of oily substance be considerably reduced, say to a fraction of one per cent. on the ore, granulation ceases to take place. What this fraction of one per cent. is, they do not mention. *The only way in which I*

can interpret this fraction of one per cent. is by referring to other portions of the specification, where this fraction of one per cent. is expressed in figures; for example, at line 81 of page 1 of the specification is the following statement, speaking of the ore:

"'To this is added a very small proportion of oleic acid (say from *0.02 per cent. to 0.05 per cent.* on the weight of the ore).'

"That is, from *1/50 of one per cent. up to one-half of one per cent.*"

Again, in answer to x-Q. 46 (Tr. Vol. I, p. 198), he said:

"These *extremes represent from .4 of a pound per ton of ore to 10 pounds per ton of ore.** The patentees do not state on what particular condition of the ore this variation of quantity depends, whether it depends upon the percentage of zinc in the ore or some other quality, but they do indicate that the selection of quantity *between these extremes* must rest with the person familiar with the art who practices the process and it is fair to assume that such person would decide how much oleic acid to use by the result of the simple preliminary tests suggested by the patentees."

Plaintiffs' expert witness Ballantyne testified as follows (Tr. Vol. I, p. 286):

"I have seen the agitation-froth process carried out many hundreds of times. I have also seen investigations of the process making wide variations step by step in the factors which I have referred to above, and I have myself, on many occasions, carried out these investigations and now know that if the instructions which Messrs. Sulman, Picard and Ballot drew up in February, 1905, are carried out, namely to use a slimy pulp, acidified with say .5 per cent. of sulphuric acid, to heat the pulp say to 30° Centigrade and then to agitate it violently

*0.4 lbs. per ton is 0.02% and 10 lbs. per ton is 0.5%.

with proportions of oil beginning at fifty pounds of oil per ton of ore and repeating this test, reducing the quantity of oil step by step down to the *vanishing point*, it is inevitable that the agitation-froth shall be produced when the *quantity of oil is diminished to the limits set forth in the patent in suit*, and that a particularly good froth and efficient concentration is obtained when the proportion of oil is about *0.1 per cent. on the ore*, the percentage recommended in the patent in suit as being suitable and economical."

In answer to x-Q. 102 he said (Tr. Vol. I, p. 323):

"In my opinion the operation of the agitation-froth process *is defined in the clearest possible terms in the patent in suit*, and this remark applies particularly to the *quantity of oil* to be used."

Further along in the same answer he said:

"I have never seen the agitation-froth process successfully carried out by the use of an amount of oil equal to practically one per cent. by weight on the ore, and *in my opinion 0.9999 per cent. of oil would not be a proper quantity* (that is to say, it would not be a suitable and economical quantity), *as contemplated by the patent*, and would not therefore be a *suitable fraction of one per cent. as contemplated by the patent*."

Plaintiffs' expert, Dr. Liebmann, testified as follows (Tr. Vol. I, p. 446):

"They inform the world what they consider the *limits of their proportions*,* and they add that in their experience *0.1 per cent.* of oil of the amount of ore has been found 'suitable and economical.' Surely one cannot demand more, and even a metallurgist of very low qualifications cannot fail to determine with the greatest ease what quantities will give him the desired results."

*The "limits of their proportions" set forth in the specifications are between 0.02% and 0.5%.

The fact is that *not a single witness in the Hyde case said or intimated that the practical proportions included quantities above 0.5%.* On the contrary, the plaintiffs' witnesses and plaintiffs' counsel, as we have seen, assured this court that larger quantities could not be used and the results obtained.

Not only is it respectfully submitted that when this Court said that the "step was not a long one", it had in mind the fact that the Froment Description recommended the use of as little as 1% on the ore and that the Cattermole proportions applied to defendant's ore would result in the use of as little as 0.88% on the ore; it is also respectfully submitted that when this Court said that the patent must be confined to the "critical proportions" often described in the testimony and in the patent, it meant that the patent must be confined to the use of not above 0.5% of oil, which is the largest amount mentioned in the patent, and which is two-and-a-half times greater than the largest amount which the testimony said had been found useful in practice.

PRIOR-ART LITERATURE IN THIS CASE WHICH WAS NOT IN THE HYDE CASE.

The only important prior-art publication in this case which was not before the Courts in the Hyde case, is the *California Journal of Technology,* published November, 1903, by the students of the University of California, and printed in the Transcript Vol. VI, pp. 2754 to 2764.

It is not contended that this publication contains an anticipation of the patent in suit as it has been construed by this Court. In other words, it is not contended that this publication describes agitation-froth concentration produced by the use of the extremely minute quantities of oil which are described in the specifications of the patent in suit (between 0.5% and 0.02% on the ore); but it does very clearly describe agitation-froth concentration pro-

duced by the use of quantities of oil as little as 2.1% on the ore. It emphasizes the fact, therefore, that agitation-froth concentration is not new with the patentees of the patent in suit. It emphasizes the fact that the only novel thing contributed to the art by these patentees is the extremely minute quantity of oil which may be used in such a process.

The article in question is entitled "Experiments on the Elmore Process of Oil Concentration". After describing a commercial installation operating the Elmore process and using 100% of oil on the ore, the authors proceed to describe the results of their own investigations. They say (p. 2757):

> "In making a test, the ore is first crushed to the desired fineness, and the proper charge is thoroughly wetted in the solution to be used (usually water), thus forming a thin pulp. The oil is next added and the whole charge thoroughly mixed. This mixing, or agitation, can be done in *two different ways.* The charge may be agitated very gently, the oil being kept in a single lake, and broken up as little as possible consistent with a thorough contact of pulp and oil; or the charge may be agitated *so violently as to dash the oil up into a foam or froth full of air bubbles;* thus a very thorough contact of oil and pulp is obtained. Each method has its advantages and disadvantages, and these are discussed later.

After describing the apparatus used, which were "ordinary percolating tubes" shown in Fig. 5 on page 2757, the article continues (p. 2758):

> "Three methods of mixing may be used. 1. By inverting the tube several times, thus allowing the ore to fall through the oil. 2. By rotating the tube in a horizontal position, thus throwing the pulp up on to the surface of the lake of oil. 3. By *violently shaking the tube, thus producing the foam effect, or at least shattering the oil into small globules.*"

After giving general directions of procedure, the authors give a table containing the results of nine experiments on molybdenite ore. Experiments Nos. 1, 2 and 3 were made according to the Elmore process using large quantities of oil and very gentle agitation so as to keep the oil in the form of an unbroken lake; while Experiments Nos. 4, 5, 6, 7, 8 and 9 were made by violent agitation so as to produce the "foam or froth" effect. These last-named experiments are described as follows (p. 2760):

> "Experiments No. 4, No. 5 and No. 6 show the results obtained by treating separate samples with *small quantities of oil,* in a salt solution, and *agitating violently to produce the foam effect. This method gives the highest grade concentrates of any of the direct treatments here outlined.* In experiment No. 6 only about 10 cc. of oil was used for 100 grams of ore. This gave an extraction of 75% with concentrates running 32.4% MoS_2.
>
> "But these concentrates were not marketable. In practice they would have to be reconcentrated. The results of a few reconcentration tests follow.
>
> "Samples of concentrates running about 26% MoS were agitated in a sulphuric acid solution 15 minutes. This agitation caused considerable of the occluded gangue to free itself. A small quantity of oil was then added and the material reconcentrated, utilizing the *foam effect.* In No. 9 a concentrate running 50.02 MoS_2 was obtained. Concentrates such as these would probably be marketable. In experiment No. 8 reconcentration was tried without the agitation in sulphuric acid solution, but the results were unsatisfactory."

The authors then describe other experiments made by them with the Elmore process on various ores, and conclude with a "Resumé" which first deals with their observations and deductions connected with their work on the "lake effect" (Elmore process), and then concludes with

the following statement concerning their experiments with the "foam effect" (p. 2764):

> "Foam Effect.—The foam effect is produced by a *violent agitation,* especially in acid or salt solutions. This throws the oil into a *froth, which is heavily charged with air or gases.* This gas of course gives a *greatly increased buoyant force.* The oil in this condition assumes a certain load of mineral and *holds it in a very stable condition.* The charge does *not settle and overload on standing* as in the case of the lake effect. The foam effect is best adapted for light, flaky minerals, such as molybdenite.
>
> "The work above outlined suggests many lines of further investigation, and as these come to be worked out, the process will become more valuable and of more general application."

Returning to a consideration of the table of experiments on page 2759, it will be observed that in Experiment No. 4 the authors used 2.1% of oil on the ore, in Experiment No. 5, 5.3% of oil on the ore, and in Experiment No. 6, 8.9% of oil on the ore. In Experiments Nos. 7, 8 and 9 they subjected samples of concentrates to reconcentration using in each case 3% of oil on the ore. In Experiment No. 7 they thereby raised the grade of concentrate from 26% to 47.9%, and in Experiment No. 9 they raised the grade to 50%. It will be borne in mind that in actual practice today the rough product first separated from the ore is invariably reconcentrated in this way to raise the grade of the concentrate.

Here, then, we find a clear description of the agitation-froth process using extremely small quantities of oil compared with the quantity of oil used by them in the Elmore experiments. It is true that this publication does not describe the use of the critical quantities of oil described in the patent in suit, to which, as we understand it, this Court has limited that patent; but it is also true

that we find here the agitation-froth process of concentration clearly described and sharply contrasted with the "bulk-oil" or "lake effect" process of concentration, and that this publication affords an additional reason why the patent in suit to be sustained must be rigidly limited to the extremely minute quantity of oil therein described, which is 0.5% on the ore as the maximum quantity, and 0.1% on the ore as the preferred quantity.

In criticizing the disclosures of this publication, plaintiffs' counsel say that neither the grade of the concentrate nor the recoveries obtained by the froth or foam effect were high. Compared with present-day practice, that is true; but the recoveries described in the patent in suit compared with present-day practice are not high. All the patent in suit says about the recovery is that the "froth may contain about seventy per cent. to eighty per cent. of the metalliferous matter" (specification, p. 1, lines 105 and 106). Compared with present-day practice, this would be a miserably low recovery. Such results today would not be called "metallurgical results". It is manifestly unfair to compare results obtained in these days with results obtained in those days, because there have been numerous improvements in apparatus and in treatment contributed to the art in the *interim*. The only fair comparison to be made is with other processes available at the time, and such a comparison the authors of this publication make in their article. The authors were simultaneously working with the "lake" effect (Elmore process) and the "froth or foam" effect, and in the table above referred to we find the results of the two processes compared. In the column entitled "Value conc. % M_oS_2" the grade of concentrate is given; and in the column entitled "% of extrac." the amount of extraction is given. It will be seen that in every experiment the grade of concentrate obtained by the "froth or foam" effect was much higher than that obtained by the "lake" effect (Elmore

process), and this fact is pointed out in the passage above quoted where it is said: *"This method gives the highest grade concentrates of any of the direct treatments here outlined".* It will also be seen that the highest extraction obtained in any experiment was 75%, and that this was obtained with the "froth or foam" effect. The extraction of 75%, it will be observed, is quite as good as anything claimed for the process in the patent in suit, which, as we have seen, only claims an extraction of "about seventy per cent. to eighty per cent." The highest extraction obtained in any of the experiments with the "lake" effect (Elmore process) was only 67.2%. The article, therefore, shows that the "froth or foam" effect gave not only higher grade concentrates, but was capable of giving a higher extraction than the "lake" effect (Elmore process).

Plaintiffs' counsel further criticize the disclosures of this publication by saying that they are only the records of laboratory experiments. That is true; but all these processes have to be worked out first in the laboratory, and the description in the patent in suit is nothing but the description of laboratory experiments. The process of the patent in suit had never been used in mill operations at the time these specifications were written and filed. The Gabbett mixer with its cone-shaped agitator, which is illustrated and described in them, is the apparatus which Minerals Separation continues to use in its laboratory for testing purposes; but it is an apparatus which has never been used in mill operations (Tr. Vol. I, p. 228, Q. 27; also p. 236, Q. 54). The apparatus described in the patent is not even capable of carrying out a continuous process.

We have called attention to the fact that these investigators made all their tests in "ordinary percolating tubes", such as are illustrated in Fig. 5 of the article. These tubes are of glass and are provided with a tap at the bottom, so that the contents can be withdrawn either

from the bottom or from the top. Such tubes as these, violently shaken by hand, are today well-known and frequently-used apparatus for making preliminary tests of the process of the patent in suit. Such tests are called "bottle tests" and are described as used to-day by the engineers of Minerals Separation, Nutter, Tr. Vol. I, p. 136, x-Q. 50 and Chapman, Vol. I, p. 249, x-Qs. 138, 139; and are also described by one of the inventors, Sulman, Tr. Vol. II, p. 978, Qs. 92 to 94.

Plaintiffs' counsel call attention to the fact that these experimenters obtained a higher recovery (but not a better grade of concentrate) using 8.9% of oil than when using 2.1% of oil. There is nothing extraordinary about this, because it is proved in this case that in using some oils, particularly petroleums, larger quantities give increased recoveries. Thus Wicks testified to mill operations using "crude oil" and "Jones oil" (both petroleum) and showed that far better results were obtained by using 50 to 60 pounds per ton (*i. e.*, about 3%) than by using 20 pounds per ton (*i. e.*, 1%) (Tr. Vol. III, p. 1462, Qs. 166 to 180). The results were not "commercial", as the witness says, "simply on account of the cost of the oil" (Tr. Vol. III, p. 1463, Qs. 179, 180).

This publication is discussed by Prof. Sadtler, Tr. Vol. III, beginning p. 1635; and the experiments therein described were repeated in Court by Prof. Sadtler, Tr. Vol. III, pp. 1646 to 1648; also Vol. IV, pp. 2061, 2062; and by Dosenbach, Tr. Vol. III, pp. 1658 to 1660.

The Process of the Patent in Suit Was Not the First Commercially Successful Frothing Process.

It is a mistake to understand that the agitation-froth process was the first process in which mineral matter was commercially and successfully separated from gangue by flotation, or that it immediately scored a success and superseded other processes. On this point the testimony

of Herbert C. Hoover (the present Food Controller of the United States) is instructive; and as the deposition is short, it should be read in full.

Mr. Hoover states that in 1905 at Broken Hill there were four processes in use, to wit: The Cattermole process, the Potter process, the Delprat process (these last two being substantially alike and now known as the Potter-Delprat process) and the DeBavey process. The Potter, the Delprat and the DeBavey processes collected the mineral matter by flotation in a spitzkasten (Vol. II, p. 1044, Qs. 5 to 7). After investigating these several processes, Mr. Hoover's Company, The Zinc Corporation, adopted the Potter process. This process is described in the Potter patents (Tr. Vol. III, p. 1277).

Briefly stated, the Potter process consists in adding to an ore containing a carbonate, or to which a carbonate has been added, sulphuric acid in quantities large enough to combine with the carbonate and liberate carbonic acid gas in the form of bubbles, which attach themselves to the mineral matter and float it to the surface where it forms a froth in a spitzkasten. In this process, no oil is used, because sulphuric acid is itself a frothing agent and when sufficient quantities are used no oil is necessary. The process did not prove a commercial success in the hands of the Zinc Corporation, although it is well-known that in other hands it has been commercially successful. In 1907 the agitation-froth process was installed in the Zinc Corporation's plant by the engineers of Minerals Separation, but it proved a total failure and the trial practically bankrupted the Company (Tr. Vol. II, p. 1045, Q. 5; p. 1047, x-Q. 25). The Zinc Corporation then adopted the Elmore vacuum process which proved to be a complete success and it continued to use said process for two or three years (Tr. Vol. II, p. 1045, Q. 5). This process is described Tr. Vol. I, p. 140, x-Q. 84; p. 150, x-Q. 157. It is a flotation process employing oil, the air used for the production of

bubbles being that which is dissolved in the water. When the pressure is reduced below atmospheric pressure the air which the water contains is released and the bubbles thus formed pick up the mineral matter and rising form a froth which is collected in a spitzkasten. The released air may be supplemented with carbonic acid gas formed by the addition of a carbonate and acid as in the Potter-Delprat process. In 1910 the Zinc Corporation substituted for this Elmore vacuum process the Minerals Separation agitation-froth process under circumstances explained by Mr. Hoover as follows (Tr. Vol. II, p. 1045, Q. 5):

> "During a considerable portion of this period my brother, Mr. Theodore J. Hoover, had been acting as the general manager of the Minerals Separation Company, and he insistently presented to me the fact that he had made such *alterations* in the Minerals Separation method that the results were superior to those which we were obtaining by the Elmore method, and upon his insistence I had the matter reinvestigated. We carried out extensive trials with the modified plant of the Minerals Separation Company, and ultimately threw out the Elmore and re-adopted the Minerals Separation."

When asked why the change was made, Mr. Hoover said (Tr. Vol. II, p. 1046, x-Q. 13):

> "In the main we changed methods because it was possible to treat a larger proportion of slimes in the Minerals Separation method than in the Elmore. While we could secure much the *same extraction* by both methods, the gangue slimes came over to a greater extent with the concentrates in the Elmore method, and consequently the concentrate secured by the Elmore was of lower grade."

When asked to explain the metallurgical situation at Broken Hill which brought about the great success of

that District, Mr. Hoover said (Tr. Vol. II, p. 1048, x-Q. 34):

> "Well, over a period of many years the Broken Hill mines were unable to profitably extract the zinc and there accumulated some ten to twelve million tons of mill residues, containing the major portion of the original zinc content. The invention of, or the application of the Potter, Delprat, Elmore, Cattermole and other methods, together with the mechanical variations and improvements which all of these flotation ideas have received, has enabled the accumulated zinc to be turned to profitable account. I may add that the great commercial prosperity of this district has been largely contributed to by the *mechanical development of the long-known flotation principle.*"

It will be observed that Mr. Hoover attributes the commercial success of flotation operations not to the discovery of any new principle of operation, but to *"the mechanical developments of the long-known flotation principle"*. In this conclusion, Mr. Hoover is amply supported by the proofs in this case. Janney, the engineer who started defendant's flotation plant in operation, testifies that he began in July, 1912—which, it will be observed, is almost six years after the patent in suit was issued—and that he struggled for almost a year before he was able to get it in commercial working operation (Tr. Vol. IV, p. 2006, Qs. 48 to 52). Dosenbach, the engineer who subsequently had charge of the plant, obtained better and better results during the years 1913, 1914 and 1915. When asked to explain these improvements in results, he describes a large number of improvements in the mode of handling the concentrates, and various improvements in the apparatus, including the adoption of an entirely new agitating machine and spitzkasten, known as the Janney Machine. As the result of these improvements, he succeeded in raising the grade of concentrates from

47.8% in 1913 to 54.82% in 1915 (Tr. Vol. IV, p. 1925, Qs. 196 and 197). Even better results are obtained today, so that the present-day results are due to the industry and ingenuity of numerous engineers, including the patentees of the patent in suit, each one of whom has contributed his own quota to the success of flotation operations.

THE EFFECT OF THE ORAL EVIDENCE PRESENTED IN THIS CASE WHICH WAS NOT BEFORE THE COURTS IN THE HYDE CASE.

The decision of this Court declaring valid claims 1, 2, 3, 5, 6, 7 and 12 was, we think, largely based on two alleged facts which were urged in argument, and claimed to be established by the proofs in the Hyde case. These were:

(*a*) That while it is possible in the laboratory with *prior-art quantities* of oil and agitation to obtain highly useful metallurgical results, yet such results cannot be duplicated in mill operations.

(*b*) That there is a "divide" which separates the territory of the prior art from the territory of the patented process, and that "divide" is determined by the quantity of oil used, to-wit, not above 0.5% on the ore.

Both of these alleged facts, claimed by the plaintiffs to be established by the proofs in the Hyde case—facts on which we think the decision of the Supreme Court in that case fundamentally was based—are abundantly proved to be fictions by the evidence in this case.

(*a*)

Are we justified in saying that in the Hyde case it was urged in argument, and claimed to be established by the proofs, that while it is possible in the laboratory with

prior-art quantities of oil and agitation to obtain highly useful metallurgical results, such results cannot be duplicated in mill operations?

Plaintiffs' counsel said in their brief in the Hyde case at page 9:

> "There is no evidence to indicate that any such processes were ever used with any practical success in the mill. There is affirmative evidence to the contrary. (See pages 196 to 200 of Brief for Petitioners-Complainants.) In a laboratory test an ore pulp, with any quantity of oil, large or small, can be whipped by an egg-beater up into a floating and dirty oil magma, honeycombed with air bubbles, like whipped cream, and carrying a considerable proportion of metal constituents of the ore, but such process would be absolutely useless in the mill for the purpose of concentrating ores.
>
> "It is in the highest degree significant that the respondent, instead of demonstrating the practicability in the mill of a process of ore concentration involving the use of notable quantities of oil, as it could perfectly well have done, if any practicable process of that kind existed or were possible, contented itself with the legerdemain of the laboratory, wholly inconsequential even at best in its implications, and stands here and now upon misrepresentation of the testimony of petitioners-complainants' witnesses and of the Privy Council decision."

What Mr. Kenyon said in argument before this Court on this point was as follows (printed report of arguments before the Supreme Court, p. 85):

> "MR. JUSTICE PITNEY: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation?
>
> "MR. WILLIAMS: Absolutely no.
>
> "MR. KENYON: It would not.
>
> "MR. JUSTICE PITNEY: I understood him to say

so yesterday, and I supposed there was something in the record to justify it.

"MR. KENYON: Nothing. That will be a part of my argument.

* * * * * *

"Now as to the allegation that agitation will achieve the end with any amount of oil, it simply is not so.

* * * * * *

"If a larger quantity of oil be added to the pulp, for example, two or three per cent., the Cattermole effect appears. With the same identical agitation, the oiled metal particles agglutinate and sink. The values are taken away at the bottom. This larger quantity of oil on the metal particle destroys the attraction of those particles for air cells, as evidenced by the fact that air is beaten into the pulp in the Cattermole agitation just the same as in the identical agitation in the process in suit, but it does nothing and escapes and, in spite of it, the values go to the bottom.

"MR. JUSTICE HOLMES: That is the formation of globules?

"MR. KENYON: The formation of globules. It utilizes the stickiness of oil.

"If still more oil than Cattermole proportions be added to the pulp, too much to act as an agglutinant, the same agitation will beat it up into a pasty magma or oil emulsion, no matter what the quantity of oil, entrapping air cells and metal particles, but having little affinity for either and destroying their affinity for each other.

* * * * * *

"These oil magmas or froths with any amount of oil can be *readily produced in the laboratory*. But they are mere laboratory freaks, *absolutely useless in the mill*. In the mill granules would tend to form and go to the bottom. The froth would be fragile and drop in great chunks. It would not hold onto the metal. It would be unreliable and uncontrollable.

"As to the proposed demonstration to-morrow, it was our purpose simply to illustrate our pro-

cess and let you see this intermediate product of our process, the froth, and the Cattermole metal-sinking process, but the respondent is concerned to prove by what he will show to-morrow alleged identity of froths by visual observation, therefore I must forewarn you.

"If the respondent tomorrow repeats the tests set out in his record, he will be doing what is nowhere shown in any part of the prior art, as our brief points out in detail.

"MR. JUSTICE PITNEY: He will be doing what?

"MR. KENYON: He will not be carrying out the processes of the prior art.

"MR. JUSTICE PITNEY: What will he be doing?

"MR. KENYON: He will be performing tests with large quantities of oil, just laboratory tests that he arbitrarily chooses to perform. He will give them the names of old processes; he will call them Everson, Kirby, Froment, but they will not be either of those three.

"1. They will be carried on in modern machinery not known at the time.

"MR. JUSTICE MCKENNA: Pardon me one question. Will they be using more than *one-half of one per cent.* of oil?

"MR. KENYON: Yes, sir; anywhere up to 25 per cent.

"MR. JUSTICE MCKENNA: Yet they result in the production of a froth?

"MR. KENYON: You will have an oily mass or magma at the top, but it will *not do anything towards concentration of ores.* I am coming right to that point now.

* * * * * *

p. 89:

"MR. JUSTICE MCKENNA: *Your contention then is that the laboratory test is no standard.*

"MR. KENYON: *Yes, sir; absolutely no standard whatever.*

"MR. JUSTICE MCKENNA: *Do you admit that the laboratory tests show a similarity?*

"MR. KENYON: *Yes. I cannot myself tell one float from another by visual observation. But the*

mill man will tell you the instant he tries to carry out the process in the mill.

"Indeed even minute departures in the mill from the standard oil quantity needed for the particular ore are harmful, and I want your Honors to mark page 196 of our brief on that point.

"Mr. Chapman was asked:

"'What has been your experience when, in using the agitation-froth process on a commercial scale, with a normal and proper consumption of one and a half pounds of oil per ton of ore, this procedure has been varied by increasing the oil feed to 2½ pounds per ton of ore?'

"NOTE: This was only a small increase. He says the tailings, on examination, immediately showed increased losses of sulfide mineral. The result was harmful.

* * * * * *

p. 90:

"MR. JUSTICE MCKENNA: *Are there any experiments on the other side showing more than laboratory tests?*

"MR. KENYON: *No, sir. They stop with laboratory tests. To-morrow you will see, but you will not know. The layman cannot tell the useful froth of the process in suit from a useless oil emulsion; whether it is a step in a real process of ore concentration or only a sham; whether it can be reproduced in the mill or not, or would treat or successfully concentrate ore. It is a situation for caution, especially as the court below was misled by just such demonstrations.*"

Mr. Kenyon supported his statement by reference to the record as follows (printed report of arguments before this Court, p. 88):

"Finally, such oil froth processes are *absolutely not usable in the mill at all.* To demonstrate that I want to turn to the evidence of Dr. Byrnes, for the defendant. I presume this will be one of the tests that will be shown you to-morrow. I do not know what it will be called to-morrow. Record,

page 108, Second Experiment Froment. 3.6 per cent. of cotton seed oil agitated in our slide machine, about two pounds of the ore treated. Result: his tailings showed only one per cent. of zinc —wonderfully clean tailings; his recovery, as figured by Dr. Liebmann (p. 299) was about 100 per cent. of the values—a remarkable recovery.

"We followed identically that same process first in a seven-ton a day plant, a semi-commercial plant, and then in a fifty-ton a day plant, a full commercial plant—to see what would happen. We did just the things there that Dr. Byrnes did in the laboratory. Mr. Higgins testified as to the first at page 387 of the record. Result: his tailings showed 12 per cent. zinc, and his recovery was only 50 per cent. of the values. Half of the values were gone. He says the float fell in masses; that the tailings had some granules (the Cattermole effect had been to some extent produced); that the recovery was not satisfactory.

"Chapman testifies as to the test in the fifty-ton plant (pp. 388-391). 1,680 pounds of ore were run through in each of the four tests. In the first test the tailings showed 17 per cent. of zinc. Seven-eighths of the original zinc in the ore was in the tailings. He then added more acid, to favor the process. 14 per cent. of the tailings were zinc. Seven-tenths of the values went away in the tailings. He then diminished the duration of the agitation, to favor it, and 17.5 per cent. of the tailings were zinc. Four-fifths of the values ran away with the tailings. He says these processes were absolute failures as to results (p. 390 of the record). Then he cut the oil in two, using 1.8 per cent. of cotton-seed oil. His tailings were 13 per cent. zinc. The recovery was 69 per cent. But he says of it that the 'result' was of 'no commercial value at all' (Record, page 391)—that there was *'really no concentration at all'* (Record, page 392) —that the *concentrate was practically of no more value in proportion of metal afterwards than before."*

Mr. Williams, in his argument (p. 33), said:

> "So we had Mr. Higgins carry out the same operation, practically the same, with 3.6 per cent. of oil in a little testing plant which was available at the mines of Senator Clarke in Butte, Montana. It was only a little plant. It was not a full size operation. In that operation he lost 50 per cent. of his metal. He said that it fell down in bunches when it spread out on the surface of the spitzkasten, and although at a little distance it looked like our floating froth, on close inspection it was found to be an oily floating mass. It fell down in bunches, and it only saved 50 per cent. of the zinc and threw away the rest of it. But we were not satisfied with that. We took the smallest full-size plant, the 50-ton plant, through which 50 tons of ore are carried by 200 tons of water in twenty-four hours, and we carried out an operation in that, and there the loss was 82 per cent. It was hopeless. *So that we demonstrated the negative of the proposition that the defendant had failed to demonstrate. We demonstrated that these products of the legerdemain of the laboratory, not prior art at all, were worthless in the concentration of ores, wholly regardless of the question of the cost of oil or anything else.*"

On behalf of the defendant in the Hyde case there was no testimony whatever contradicting these statements. Indeed, it was not possible at the time the proofs were taken in that case to produce such testimony, because it was not until the spring of 1913 that the defendant became convinced that flotation would be a success in its mill operations, and adopted it (Tr. IV, p. 2007, x-Qs. 53, 54), while the testimony in the Hyde case was closed before the beginning of the year 1913 (Tr. Vol. I, pp. 553, *et seq.*).

So, in the Hyde case, the proofs were all to the effect that a quantity of oil above 0.5%, while apparently capable of yielding useful metallurgical results in the labora-

tory, was incapable of yielding similar results in mill operations.

In this case the converse of that proposition is abundantly established.

This defendant, as already stated (*supra*, p. 3), continuously used in daily practice, subsequent to February, 1917, oil in quantities greater than 1% on the ore. This conclusively establishes the fact that the use of oil in quantities greater than 1% on the ore produces commercial results not only in the laboratory, but likewise in the mill.

Again, Defendant's Exhibit 31 (Tr. Vol. VI, after p. 2736. See column entitled: "Total New and Circulating Oil", sub-title: "Per ton Total Feed") gives the results of a series of mill operations at the Arthur plant of the Utah Copper Company in which different quantities of the same oils were used.*

In the first series of these mill experiments (Nos. 1 to 13) the same oil mixture was used varying in amount from 6.87 pounds per ton to 96.46 pounds per ton (*i. e.*, from about 0.33% to 5%). An extraction of 96.39% was obtained with the use of 5% of oil. While a higher extraction (98.41%) was obtained with the use of less oil (25.50 pounds per ton) yet the difference is clearly one of degree and not of kind. These operations are explained by Janney, Tr. Vol. III, pp. 1516 to 1521.

It is also shown by the proofs that the Utah Copper Company at its Magna Plant (Tr. Vol. III, p. 1568, Q. 129

* In the supplemental brief for plaintiffs (p. 137) a portion of the cross-examination of the witness Janney is quoted, in which the witness said that the amounts of oil used in these experiments were not correctly set down in the Exhibit, and that, therefore, the Exhibit was unreliable. These answers require explanation to avoid being misunderstood. As the context shows, what the witness admitted was that the Exhibit only showed the amounts of oil added, and did not take into account the amount of oil which was carried in the circulating load, or in the water before it reached the agitator. The amount of oil actually present was, therefore, always *in excess* of the amount stated in the Exhibit by a constant factor, which factor, the witness says, he did not determine. Only in that sense (a sense altogether favorable to the plaintiffs) is the table in error.

et seq.) and at its Arthur Plant (Exhibit 30, Tr. Vol. VI, p. 2736; also Tr. Vol. III, p. 1512, Q. 34 *et seq.*), the Chino Copper Company (Exhibit 26, Tr. Vol. VI, p. 2736; also Tr. Vol. III, p. 1445, *et seq.*), and the Ray Consolidated Copper Company (Exhibit 44, Tr. Vol. VI, p. 2752; also Tr. Vol. III, p. 1609, *et seq.*), subsequent to December, 1916, used in their daily practice oil in quantities greater than 1% on the ore.

At the Magna plant of the Utah Copper Company the change from below 1% to above 1% of oil on the ore was made on December 25, 1916. Before the change was made, the smallest quantity of oil used was in the month of March, 1915, when the average was 1.23 pounds per ton; and the largest quantity used was in the month of April, 1916, when the average was 5.37 pounds per ton (Tr. Vol. III, p. 1565, Qs. 92, 93). Before the change, a mixture of various oils, including petroleum was used. In August, 1915, they used a mixture of Barrett creosote, Barrett No. 4, Jones oil, pine oil, and an oil called No. 642, which is a reconstructed pine oil (Tr. Vol. III, p. 1584, x-Q. 268). In August, 1916, they used a mixture of Jones oil, creosote and waste oil (Tr. Vol. III, p. 1585, x-Q. 281). In December, 1916, before the change was made, they used a mixture of Jones oil and creosote (Tr. Vol. III, p. 1586, x-Q. 286). After the change was made they used a mixture of Jones oil and Yaryan pine oil (Tr. Vol. III, p. 1586, x-Q. 289). Defendant's Exhibits 35 and 36 (Tr. Vol. VI, p. 2752) give a complete statement of the mill operation before and after the adoption of the use of larger amounts of oil than 1% on the ore. Exhibit 35, which gives averages for the entire period before the adoption of 1% of oil, compared with Exhibit 36, which gives averages for the entire period after the adoption of 1% of oil, shows that the extraction before the change was 97.461% and after the change was 98.161%. They show that the copper in the concen-

trates before the change was 30.294%, and after the change it was 28.458%.

At the Arthur plant of the Utah Copper Company the change from below 1% to above 1% of oil on the ore was made December 21, 1916. A tabulation of the results before and after the change is contained in Defendant's Exhibit 30 (Tr. Vol. VI, between pp. 2736-2737). Before the change, an average of 3.76 pounds of oil per ton of ore was used, and after the change an average of 21.98 pounds of oil per ton was used. Before the change, the tailings averaged 0.361% of copper; after the change they averaged 0.238% of copper. Before the change, the recovery was 96.57%; after the change, it was 96.60 (Tr. Vol. III, p. 1514, Q. 46). Both before and after the change they used mixtures containing petroleum as one of their ingredients.

At the mill of the Chino Copper Company the permanent change from below 1% to above 1% of oil on the ore was made December 21, 1916 (Exhibit 26, Tr. Vol. VI, p. 2736; also Tr. Vol. III, p. 1448, Q. 35), although they had for three days in November, 1916, used as much as 23.7 pounds of oil per ton of ore (Tr. Vol. III, p. 1446, Qs. 16 and 17). Before the change, they used a mixture of creosote (Barrett No. 4) and petroleum (Jones oil), and since the change they have been using the same mixture (Tr. Vol. III, p. 1449, Qs. 42-44). The tailings loss of copper averaged, before the change, 0.48%; and, after the change, 0.32%. The average recovery before the change was 95.528%; and after the change, 96.936% (Tr. Vol. III, p. 1449, Q. 50). After the change the average amount of oil used was 22.18 pounds per ton of ore (Tr. Vol. III, p. 1448, Q. 37).

At the mill of the Ray Consolidated Copper Company the change from below 1% to above 1% of oil on the ore was made the middle of January, 1917. A tabulation of the results before and after the change is contained in Defendant's Exhibit 44 (Tr. Vol. VI, opposite p. 2753).

Before the change they used a mixture of creosote (Barrett No. 4) and petroleum (fuel oil), and since the change they have been using the same mixture (Tr. Vol. IV, p. 1865, Q. 37). Before the change of quantity of oil varied from 3.22 pounds to 5.28 pounds per ton of ore (0.25%). Since the change it has varied from 18.77 pounds to 21.19 pounds per ton of ore (Tr. Vol. IV, p. 1864, Q. 31). The average extraction before the change varied from 91.80% to 96.52% in different years; and since the change it has been between 94.48% and 96.19%. The average copper in the tailings before the change varied from 0.397% to 0.617% in different years; and since the change it has been between 0.368% and 0.452%. At this mill also experiments were made to determine the results of keeping the mixture of oil constant, and varying only the quantity used, which experiments showed that with the mixture now employed inferior results were obtained when a diminished quantity of oil on the ore was used (Tr. Vol. IV, p. 1870, Q. 73, *et seq.*).

The above proofs in this case completely fill the blank which was left in the proofs in the Hyde case. They completely demonstrate that in the mill, as well as in the laboratory, the froth concentration process can be carried out with more than 0.5% of oil, and even with more than 1% of oil. They completely confirm the statements made to this Court by defendant's counsel in the Hyde case, and the tests made by them in the presence of this Court showing such process practiced with more than 1% of oil. They completely refute the statements made by plaintiffs' counsel to this Court in the Hyde case, above quoted, that while such process could be practiced in the laboratory using more than 0.5% of oil, it could not be practiced in the mill. These proofs relegate to the realm of fiction alleged facts which, we think, largely induced this Court in the Hyde case to find valid the fraction-of-one per cent. claims of the patent in suit.

(*b*)

Are we justified in saying that it was alleged in argument, and apparently established in the proofs in the Hyde case, that there is a "divide" which separates the territory of the prior art from the territory of the frothing process, and that such "divide" is determined by the quantity of oil used, to-wit, below 0.5%?

The testimony in the Hyde case on this point has heretofore been set forth in this brief (*supra*, pp. 13-21). It only remains, therefore, to state what Mr. Kenyon said on this point in his argument before this Court (printed report of argument before the Supreme Court, p. 91):

> "Now, the very best possible argument of invention is found right on page 448 and page 451 of the record [*'i. e., pp. 658 to 662 of the Transcript in this case'*]—the story of the birth of the invention. Because as the quantity of oil was diminished (see column three of 'Details of Experiments,' p. 448, *'i. e., p. 659 of the Transcript in this case'*)—as the quantity of oil was diminished the Cattermole granulation became worse and worse. That was degree. *But there came a time when you got over the divide, and something else happened. Just the contrary happened.* As you then from that point went on diminishing the oil that new result increased. That was not degree. *You had gone over the divide. You were in a new country.*
>
> "It is apparent now that the inventors in their *minute one-tenth of one per cent.* oil frothing reagent were really invoking a characteristic and a power of oil in an ore concentration process that develops *only in that relatively microscopic quantity,* and which is defeated and disappears when that *minute quantity is even slightly exceeded,* a characteristic and a power of oil which had not existed in the prior oil concentration processes of the art, which had never been utilized by anybody for ore concentration, and the very existence of

> which had not been known or suspected. They were invoking the power of oil when present in *microscopic amount* to exercise the powers of the air to search out and find in the swirling vortex of the pulp, and hold on to through the seven or eight minutes of agitation, and safely bring to the top at the end, the valuable mineral particles and hold on to them there until they could be floated away. They harnessed the giant of the air to their task, and the oil was only curb and bit. It was a wholly new role for oil to play, a wholly new function for oil to perform, a wholly new combination of oil and air. That takes this process right out of the oil concentration art. It is not a process of oil concentration. It is a process of air concentration, as both the House of Lords and the Privy Council have held."

In this connection we also refer this court to the colloquy between Mr. Justice McReynolds and Mr. Kenyon, quoted *supra* (p. 17).

In the present case the court hears nothing about the "divide", or about the "critical" and "microscopic" quantities of oil which alone will do useful work; for here it is admitted that *prior-art quantities* of oil will do useful work, and it is sought to make the patent cover such quantities—any quantity, in fact, which will do useful work.

Why Defendant and Others Use Only a Little Above 1% of Oil and Do Not Use Larger Quantities.

Counsel for plaintiffs comment on the fact that in each of the above-named mills and in defendant's mill amounts of oil only slightly above 1% were used. They say these people were very careful not to use much above 1% of oil. The inference sought to be drawn from this is that larger amounts of oil could not be used. Such inference is not justified. Experiments on mill scale with much larger quantities of oil have already been described

(*supra*, pp. 38-41), which experiments show that, except for the matter of cost, much larger quantities might be used.

The witnesses explain why they abstain from using much more than 1% of oil. Thus T. A. Janney of the Utah Copper Company explains that to run the flotation plants of their mills to their full capacity, using no more than 20 pounds per ton of ore, would require 87,500 gallons of oil per day, and that they should carry at least 60 days' supply on hand to be safe (Tr. Vol. III, p. 1527, Qs. 175, 176). This witness also states that their slimes plant was not in operation because they could not get enough oil to run it (Tr. Vol. III, p. 1526, Q. 170).

Dosenbach, one of defendant's engineers, says the defendant has had great difficulty in obtaining the amount of oil required (Tr. Vol. IV, p. 1930, Q. 245 *et seq.*).

Engleman of the Ray Consolidated Copper Company, said, "it has practically been to date impossible to get enough oil to continue operations daily with the use of more than 20 pounds of oil per ton on seven thousand tons of feed" (Tr. Vol. IV, p. 1871, Q. 80).

Wicks, of the Chino Copper Company, says that they had "a great deal of difficulty in some instances in getting the tank cars and in getting the oil delivered" (Tr. Vol. III, p. 1464, Q. 189), and he explains from the records that on certain days the quantity of oil used was cut down because they could not get sufficient oil to run at full capacity, using more than 1% (Tr. Vol. III, p. 1485, x-Q. 405, and p. 1487, x-Q. 427).

Furthermore, take into consideration the question of cost—the first consideration in all mill operations. At present the oil mixture which defendant uses costs about 12 cents per gallon. (This figure is not given in the record but is based on current prices.) Janney, in his testimony above referred to, tells us that his Company, using no more than 1% of oil per ton, would consume

87,500 gallons of oil per day. That would mean a daily oil-cost of about $10,500.00 and a yearly oil-cost of about $3,832,500.00. Every 0.1% increase of oil above the minimum amount which will do the work is, therefore, a useless increase of oil-expense to the amount of $383,250.00 per year in such a plant. With these facts in mind, it is not to be expected that one would use more oil than is necessary to avoid infringement.

In Using More Than 1% of Oil Defendant Does Not Obtain the Results Which Could be Obtained by Using the "Critical" Quantities of Oil to Which This Court Limited the Valid Claims of the Patent in Suit.

Plaintiffs put on the stand a witness who made a comparison between defendant's operations before and after adopting the use of more than 1% of oil and calculated that defendant's decrease of profit on one year's treatment due to the use of this large amount of oil would amount to about $1,015,000 (Tr. Vol. V, pp. 2564 to 2573).

It will be seen, therefore, that according to plaintiffs' own figures defendant has sacrificed *about a million dollars a year* in recoveries and added expenses in avoiding trespass upon the rights of the plaintiffs, as they have been defined by this Court; and that, therefore, the defendant not only does not use the "critical proportions" of oil to which plaintiffs' patent is limited, but it is not obtaining the results which could be obtained by the use of such "critical proportions".

What we understand this Court sustained the patent for is the difference between the results produced by the use of less than 0.5% of oil and the results produced by the use of larger quantities of oil.

PLAINTIFFS ADMITTED IN THE HYDE CASE THAT A METAL-BEARING FROTH COULD BE PRODUCED WITH 1% AND MORE OF OIL BUT IT CONTENDED IT WAS NOT THE METAL-BEARING FROTH OF THE PATENT, BEING MORE OILY AND CARRYING LESS VALUES.

When this Court condemned the claims which were broad enough to cover the use of any "small quantity" of oil, it was fully advised of the fact that using larger quantities of oil than 1% would produce a metal-bearing froth which differed from the froth produced by the use of around 0.1%, only in that the former contained more oil and gave inferior results. Concerning this froth, plaintiffs said that it was "*A froth*", but was not "THE *froth*". Defendant's froth, being obtained by the use of more than 1% of oil, is necessarily more oily than one produced by the use of around 0.1%; and, as we have seen, plaintiffs' counsel admit it produces inferior results. Defendant's froth is, therefore, the froth which plaintiffs themselves in the Hyde case told this Court was not THE froth of their patent.

As we shall now show, both sides agreed in the Hyde case that a metal-bearing froth can be produced by the use of more than 1% of oil in the laboratory. Defendant's witnesses testified in the Hyde case, as we shall sho that in an experimental apparatus a highly usef l mineralized froth could be produced by the use of quantities of oil many times 1% on the ore. This fact was nowhere denied by plaintiffs. Plaintiffs, indeed, admitted that recoveries substantially as high as those claimed for their process in the specifications of the patent in suit could be obtained, and had been obtained by them, in a 50 ton testing plant, with the use of more than 1% of oleic acid, the specific oil mentioned in the patent in suit. Concerning these froths, plaintiffs said in substance: "We admit they are *metal-bearing froths* but they are not OUR froth. OUR froth is a *dry* froth, is

one which is obtained by the use of the *most economical quantity* of oil, and is one which contains the *maximum* amount of metal. These froths produced by the use of more than 1% of oil are *oily*, are *wasteful of oil* and contain *less metal*. They are not, therefore, THE froth of the patent."

Thus, Hyde, in the Hyde case, described a series of tests using oil above 1% on the ore. In one test he used 32.4 pounds of oleic acid per ton, which would be a little more than 1.5% (Tr. Vol. II, p. 864). In another, he used as much as 72 pounds of straight cotton-seed oil per ton, which is 5.6% (Tr. Vol. II, p. 864). In both cases he obtained a highly mineralized froth and good recoveries. Samples of the ores used and a duplicate of the machine used were furnished to the plaintiffs (Tr. Vol. II, p. 878, x-Q. 105; also p. 879; also p. 943). The results of these tests were never questioned by plaintiffs' witnesses.

So also defendant's expert, Dr. Byrnes, testified to certain experiments made by him with different large quantities of oil (Tr. Vol. II, pp. 922-923). He used more than 3.6% of cotton seed oil in one experiment; and the same amount of olive oil in another experiment; and the same amount of oleic acid in another experiment; and one-half the quantity of oleic acid (to wit, 1.8%) in another experiment. In all cases he obtained a highly mineralized froth and good recoveries.

These facts were not denied or questioned by plaintiffs' experts in the Hyde case. All that plaintiffs' experts said was, that these high recoveries obtainable on an *experimental machine* could not be duplicated in *mill operations*.

While plaintiffs' witnesses denied that as good recoveries could be obtained in mill operations as were obtained in experimental machines when using large quantities of oil, they did not deny that, in their own 50-ton testing plant in London, a copious mineralized froth, using more

than 1% oleic acid, could be obtained. All they contended was, that the froth was more "*oily*" and not as "*dry*" as the froth produced by the use of a very small fraction of 1%, and that it did not produce as *high recoveries* as could be produced by the use of a very small fraction of 1%. They said it was an "oil froth" and not an "air froth", and they said it was not, therefore, THEIR *froth*.

For example, plaintiffs' expert Chapman (Tr. Vol. I, p. 556, Q. 250), used in said 50-ton testing plant 1.8% *straight oleic acid*, and obtained a froth recovery of 69.78% zinc, and 70.40% lead. While this is not as good a recovery as Hyde and Byrnes obtained in their slide machine experiments above referred to, yet it was a very good result, as is indicated by the fact that the *patent in suit only claims for the process a recovery of "about 70% to 80%"* (p. 1, line 105).

So, Higgins reproduced in a 5-ton testing plant Dr. Byrnes' experiment, using 3.6% *straight cotton-seed* oil (Tr. Vol. I, pp. 551, 552), and obtained a "copious" froth which "though oily in appearance *when closely examined*, did not differ in appearance from the usual agitation froth at a *distance of a few feet.*" It is true that Higgins did not get as high recovery as did Byrnes, but that is beside the point. The point is, that he admits that a "copious" mineralized froth was produced by the use of 3.6% straight cotton-seed oil and that concentration was thereby effected, because the amount of zinc in the concentrate was as much as 47.54%, whereas in the ore treated it was only 20.41%, and because the gangue in the concentrate was only 11.82% whereas in the ore treated it was as much as 59.95%. Admitting that this froth was more oily than a froth produced with a small fraction of 1% of oil (as, of course, it must have been), and admitting his contention that the recovery when using 3.6% was less than when using a very small fraction of 1%, the fact remains that he admits that froth concentration can be produced by using straight oils in quantities above 1%

on the ore; and this fact was before this Court when it condemned as too broad claims 9, 10 and 11.

The view advanced by plaintiffs' expert Dr. Liebmann, which was evidently adopted by this Court, was that the froth produced by the use of an excess of oil above the minute and economical proportions set forth in the patent, is not THE froth of the patent in suit. Concerning the experiments of Dr. Byrnes above referred to, Dr. Liebmann said (Tr. Vol. I, p. 432):

> "He then used the same process with very much larger quantities of oil and states again that he obtained a froth. There may be what is *popularly called a froth,* but this froth differs in characteristic qualities from THE froth produced with the quantities of oil described by the patentees of the patent in suit as suitable and economical. It contains large quantities of oil which are quite visible and can even be detected by the touch. The appearance of the minerals is changed. They have a dull look and lack the metallic luster of minerals. The agitation froth produced with the quantities of oil which the patent in suit informs you are suitable, does not disclose the presence of any oil. The faint traces of oil which must be there are absolutely invisible and only a careful chemical analysis can show their presence. To the touch the concentrates thus obtained are the same as the ordinary mineral which had never been treated with any oil. I cannot understand why Dr. Byrnes produced these experiments. He only proves that he can produce, with much larger quantities of oil than are considered economical by the patent in suit, *a froth,* but at the same time he proves that the quantities recommended as economical in the patent in suit are economical."

Further he said (Tr. Vol. I, p. 503):

> "A. I have myself not made such an experiment and I am not speaking from personal experience. I am of opinion, as I stated, that if a froth is

produced with quantities of oil such as are used in four or five experiments, it must lack some of the characteristics of THE agitation froth; that is, for instance, it would not show the metallic lustre and would be oily."

Further he said (Tr. Vol. I, p. 507):

"A. I have seen many times concentrates produced even with much smaller quantities of oil than used by Dr. Byrnes, and in each case I found the appearance greatly different from the appearance of THE agitation froth. Even quantities *as small as 1.5 per cent.* alter the look of the mineral particles."

IN PRECISELY THE SAME SENSE DEFENDANT'S FROTH IS NOT THE FROTH OF THE PATENT.

In using more than 1% of oil on the ore, defendant obtains, and must necessarily obtain, a froth which is "oily" compared with the froth which is produced by the use of a very small fraction of 1% and, as shown above (*supra*, p. 45), defendant does not, in fact, obtain as good recoveries as it previously obtained when using a small fraction of 1%. Hence, defendant is now doing only what this Court has said, in condemning the small-quantity claims 9, 10 and 11, it has a right to do.

Judged by the standard which plaintiffs applied to distinguish the froth of the patent from prior-art froths, defendant does not infringe. Defendant's froth is of necessity more *oily* than a froth produced by the use of a small fraction of 1% of oil. It is produced by an *uneconomical* use of oil. It carries *less values*.

Plaintiffs in their brief in this case say that defendant cannot avoid infringement by practicing a process *"badly"*. We reply: that all depends on circumstances. Plaintiffs told this Court in the Hyde case that if one practiced the process "badly" it was not THEIR process. It

will be remembered that, as already pointed out (*supra*, p. 48), plaintiffs' expert witnesses in the Hyde case admitted that using as much as 1.8% of straight oleic acid they obtained as good recovery as is claimed in the patent in suit (70%), and that when using 3.6% straight cottonseed oil they obtained a froth which effected concentration, which froth "did not differ in appearance from the usual agitation froth at a distance of a few feet"; and they said that this was A froth but it was not THEIR froth. They said it was not THEIR froth because it was *more oily* (as, of course, every froth produced with more oil must be, when compared with a froth produced with less oil), and because the grade and recovery was *not as high* as could be obtained with the use of about 0.1% of oil. When the defendant produces a froth which is of necessity *more oily* than plaintiffs' froth, and which plaintiffs admit produces a grade and recovery *less favorable* than could be obtained using less oil, plaintiffs say defendant is practicing their process "badly", unmindful of the fact that if the patent in suit covers practicing the process "badly", then it covers the prior art processes and is invalid.

That which does not anticipate, if earlier, cannot infringe, if later. To hold that defendant infringes when it uses more than 0.5% and even more than 1% of oil, would be to say that the defendant infringes when it uses prior-art quantities of oil. It would be equivalent to saying that by the issuance of the patent in suit the public has been deprived of the right to continue to do what it had done before these patentees entered the field.

THE DECISION OF THE DISTRICT COURT IN THIS CASE DISCUSSED.

As we have said, the opinion of the District Court in this case seems to us to be a reaffirmance in all respects of its opinion in the Hyde case, *including the errors in*

it which have been condemned by this Court. The District Court, we think, erred in not giving sufficient weight to that part of this Court's opinion beginning with the statement: "While we thus find in favor of the validity of the patent, we *cannot agree with the District Court in regarding it valid as to all the claims in suit",* and ending with declaring claims 9, 10 and 11, covering the use of any "small quantity" of oil, invalid. In fact, the District Court now intimates that this Court committed error in condemning these claims 9, 10 and 11, for, referring to the fact that this Court has condemned them, it says (Tr. Vol. I, p. 99):

> *"With the later knowledge of this suit it is doubted whether such would be the decision now."*

As we have seen, the plaintiffs in the Hyde case, by their witnesses and by their counsel, told the Supreme Court that the invention consisted in the use of a critical amount of oil, and this Court found such to be the fact. The District Court, however, boldly says such is not the fact. It says (Tr. Vol. I, p. 94):

> "The tendency was to attach *prime importance to reduction in amount of oil used,* when in fact this is but a *necessary incident (for which there are substitutes if not equivalents) to the creation of the infinitude of bubbles that do the work.*
>
> * * * * * *
>
> "These 'critical proportions' are like those *known to and solved by every child with its pipe and bowl of suds.* Too little soap, the bubbles are few, small, fragile, and break quickly. Too much soap, they flow from the pipe in a torrent, are heavy, and refuse to float. The right amount of soap, the 'critical proportions', his bubbles are large, detach readily and float high, far and for long. So it is with the bubbles in this process (p. 96).
>
> * * * * * *

> "It seems clear *neither patent nor decision undertakes to say the process depends upon less than 1 per cent. of oil* or is inoperative with 1 per cent or more of oil.
>
> "It is true that *in the beginning and during the Hyde suit the patentees inclined to so believe,* or at least believed better results would be obtained with a fraction of 1 per cent. of oil. *Perhaps limited investigation and experience with few ores and oils justified the belief*" (p. 98).

Indeed, the District Court in this case, instead of being guided by the finding of this Court, that the essence of the patented process resides in the use of a small and critical fraction of oil, has advanced and adopted a theory of operation, and of the difference between this process and prior-art processes, which is different from and inconsistent with the theory adopted by this Court; and which new theory, so far as we know, was never suggested by plaintiffs' witnesses or by their counsel. It finds that the essence of the patented process resides in the creation of an *"infinitude of bubbles"* in the pulp. If plaintiffs' witnesses or counsel had advanced such a contention, it would have been easy to dispose of it conclusively.

Indeed, plaintiffs' witnesses and counsel have themselves stated in the most explicit manner that in the practice of the old Cattermole process they used the same agitating apparatus, and operated it at the same speed, as in practicing the process at bar. Using the same agitating apparatus and operating it at the same speed must necessarily have beaten into the pulp the same "infinitude of bubbles". For example, plaintiffs' counsel in their brief before the District Court in this case (p. 23), said:

> "It is the actual fact that the degree of agitation employed by the patentees in and by the use of the Gabbett mixer at the birth of the invention in suit was *identically the same in every respect*

> with the agitation that they had been employing for the Cattermole process. The *same machine* was used, the *same speed of rotation* was used, the pulp was manipulated in *identically the same way.* There was no doubt of this fact on the face of the Hyde record, as it went up in somewhat abbreviated form to the Supreme Court, but even if that were not so the actual fact has been proved in this case (Higgins, Tr. Vol. V, p. 2509, Qs. 354-358). Not only was the *same identical Gabbett mixer* in use in the spring of 1905 both for the Cattermole process and for the process of the patent in suit, and *rotating at identically the same speed,* but this was repeated in Court at the present trial in several demonstrations, * * *"

Clearly, therefore, plaintiffs' counsel cannot and do not say that the process at bar differs from the Cattermole process in the number of bubbles introduced into the pulp.

So, also, with respect to the process which Froment communicated to these patentees December 29, 1903 (Tr. Vol. II, pp. 595 to 600), which was seventeen months before the application for the patent in suit was filed, and long before the earliest date alleged as the date of conception of the invention at bar.* A comparison of Froment's Description with the early practice of the invention at bar in Australia (where it was first practiced commercially) shows that precisely the same speed of rotation of the mixers and the same period of agitation was employed, so that the same "infinitude of bubbles" must have been present in one case as in the other. In fact, the only difference between the two processes is that in one case (Froment) 1% or more of oil was used, and in the other case (patent in suit) about 0.1% of oil was used.

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*Referring to the Sulman & Picard Report dated March 3, 1905 (Tr. Vol. II, p. 653), plaintiffs' counsel said in their brief below: "This is the earliest document describing the invention and fixes the date of invention as between March 3 and March 10, 1905."

Froment's Instructions are found in Transcript Volume II, pages 595 to 600, and the description of the early practice of the invention at bar in Australia is described in the testimony of Wincey, Transcript Volume I, pages 349 to 354.

Froment instructed the patentees to run the mixers at "about 300 revolutions per minute" (Tr. Vol. II, p. 595). In Australia they run the mixers "from 265 to 270 revolutions per minute" (Tr. Vol. I, p. 354, x-Q. 48).

Froment instructed the patentees to agitate the pulp in the mixers "about ten minutes" (Tr. Vol. II, p. 597). In Australia the pulp was subjected to agitation in the mixers "from 5 to 10 minutes" (Tr. Vol. I, p. 354, x-Q. 49).

Froment, however, instructed the patentees to use from 1% to 2% of oil on the ore up to 15% metalliferous content (Tr. Vol. II, p. 597); while in Australia they used "from 0.9 to 1.3 pounds per ton", which is about 0.05% (Tr. Vol. I, p. 351, Q. 21).

This testimony conclusively proves that precisely the same "infinitude of bubbles" must have been introduced into the pulp by Froment as by the patentees in the practice of the process at bar.

If, therefore, plaintiffs' counsel had advanced in this case (as they did not) the "infinitude of bubbles" theory, it would have been easy for us to demolish it on their own proofs.

The Court below found infringement in the use of more than 1% of oil not on the theory that petroleum is inactive in the process, but on the theory that:

(1) Since a small fraction of 1% will do the work as well as, or better than 1% or more of oil, all the oil used by the defendant above a small fraction of 1% is useless and wasted, or worse.

(2) Because, since a larger quantity always includes a smaller quantity, in using 1% and more of oil, defendant uses a small fraction of 1% *and more.*

(3) By using a small fraction of 1% defendant infringes the claims sustained, and it does not escape infringement by using unnecessarily and wastefully and detrimentally a larger quantity.

Our answer is that if this were a case in which the patentees were the first to use oil in any quantity for flotation purposes, the fact that the defendant unnecessarily and uselessly and detrimentally employs larger quantities than those described in the specifications, might not avoid infringement; and in such a case the logic of the decision below might be sound; but, under the particular facts of this case, the logic of the decision below completely annuls the limitations which this Court has placed on the claims sustained, and directly contradicts the theory on which this Court sustained the claims which are limited to the use of a fraction of 1% of oil and condemned the claims limited only to the use of a "small quantity" of oil.

That only "minute" and " critical" quantities of oil would produce THE froth of the patent in suit, is a fact reiterated by plaintiffs' counsel throughout their entire brief before this Court in the Hyde case as above pointed out (*supra,* pp. 14-17).

Here is a case in which the plaintiffs, in order to sustain their patent, told this Court that the result sought could be obtained only by limiting the oil to "critical" and microscopic quantities, and that prior art processes which used larger quantities of oil and which, therefore, necessarily produced a more "oily" froth and less economically did not anticipate. And yet when defendant uses larger quantities than Froment recommended and Cattermole directed (see *supra,* pp. 8-10) the District Court found that it infringes nevertheless, because the excess oil is "wasted". Plaintiffs obtained a favorable decision from this Court by convincing it that the presence of more than 0.5% of oil on the ore would defeat the process. The

District Court has found that it will not defeat the process but will only "waste" oil.

Defendant does not use more than 1% of oil because it cannot use less and obtain more satisfactory results. It uses it because this Court has said it is not at liberty to use less than 0.5%, but that it is at liberty to use more than that. Out of abundance of caution, and dreading the fire like every burned child, defendant has used not only more than 0.5%, but it has at times used more than 1% of oil on the ore. To respect the property rights of the plaintiff as defined by this Court is, plaintiffs' witness says (*supra*, p. 45), costing the defendant in reduced recoveries and increased costs over a million dollars a year. Of course, in one sense it is true that any excess oil above the smallest quantity which will do the work is "wasted". What this Court has held is, that the soul of this invention is the avoidance of that "waste", with the superior metallurgical results and the less "oily" froth incident thereto. Defendant has not avoided that "waste" with its accompanying disadvantages of lower recoveries and a more "oily" froth, and therefore it has not infringed.

Again this Court held that the claims of the patent which were broad enough to cover the use of any "small quantity" of oil were too broad and were, therefore, invalid; yet the District Court has, in fact, expanded the claims which were sustained by this Court so that they cover the use of oil in any quantity *however large it may be*, so long as it will produce a metal-bearing froth. In so doing, it has totally neutralized the decision of this Court condemning claims 9, 10 and 11, for, by construction, it has expanded the other claims fully to cover the territory of the condemned claims and more. It has expanded the sustained claims to cover not only the use of any "small quantity" of oil, but to cover the use of even a *large* quantity, on the theory that the oil which is used above a small fraction of 1% is wasted and it is not to be

reckoned as the oil of the claims. We submit that any process of reasoning which arrives at this conclusion is essentially fallacious.

Furthermore, the distinction which the District Court made between a beneficial use and a wasteful use of oil, holding that if the excess above a small fraction of 1% were beneficial it would be no infringement and finding infringement because it is detrimental, ignores entirely the theory on which the patent was differentiated from the prior art and sustained. It says (Tr. Vol. I, p. 100):

> "If the excess oil were effective and useful, and not inert, useless and harmful, it would be without the claims of the patent, would be of that the patentees abandoned to the public, and *would involve no infringement.*"

We show (*supra*, pp. 46-50) that plaintiffs admitted in the Hyde case that a metal-bearing froth could be produced by prior-art quantities of oil. Admitting this, they said that such froths were not THE froths of the patented process, because they were *more oily*, were *not produced economically*, and *carried less metal*. When the defendant now produces a froth using the prior-art quantity of oil, which froth is *more oily* than the froth produced by the quantities of oil specified in the patent, and is *less economical*, and carries *less metal*, the District Court finds that it infringes *for that reason*. So a process which was held not to anticipate because it was more wasteful and less efficient, is *held to be an infringement for the reason that it is more wasteful and less efficient!*

THE CLAIMS CANNOT BE STRETCHED TO COVER THE USE OF OIL IN MORE THAN THE "CRITICAL" PROPORTIONS BY THE APPLICATION OF THE DOCTRINE OF EQUIVALENTS OR BY ANY OTHER EXPEDIENT.

Cases are quoted in plaintiffs' brief in support of the proposition that infringement may be found where the letter of the claim is avoided. That proposition is un-

doubtedly sound, but, like other sound legal propositions, it is surrounded by limitations. If this were not true, claims would be meaningless and superfluous. If this were not true, the provisions of the Statutes (Sec. 4888), which require the patentee to "*particularly point out and distinctly claim* the part, improvement or combination which he claims as his invention or discovery" would be a dead letter.

Plaintiffs cannot by resorting to the doctrine of equivalents, or by any other expedient, wipe out of their patent any limitation which this Court has imposed upon it.

This case is on all-fours with the case of *Union Metallic Cartridge Co.* vs. *U. S. Cartridge Co.*, 112 U. S. 624. In that case the patent related to a machine for making cartridge cases. The machine as described in the patent contained a movable die and a stationary bunter. Defendant used a stationary die and a movable bunter, which plaintiff contended was an equivalent, and which ordinarily would be regarded as an equivalent. But as a condition to extending the patent, the Commissioner of Patents had required the patentee by disclaimer to erase the description of a stationary die and movable bunter, which did not appear in the patent as originally issued, but which had been added by a reissue. The Supreme Court, speaking by Mr. Justice BLATCHFORD, said that it did not make any difference whether a stationary die and movable bunter, such as the defendant used, was, or was not, as a matter of fact, the equivalent of a movble die and stationary bunter, such as the patentee described. The facts of the case, the Supreme Court said, were such as to prevent the patentee (p. 645)

> "being *heard to allege* that persons who use machines with a stationary die D and a movable bunter E infringe the claims of the reissue. * * * *The question of fact is not open now* as to whether Allen invented at any time the stationary die D and movable bunter E, or as to whether it was, or is, or

could be, a mechanical equivalent for the movable die D and stationary bunter E, because those questions are concluded by the disclaimer."

The same reasoning applies in this case. Having secured a favorable decision in this Court on the allegation that a larger amount of oil *is not* the equivalent of the "critical proportions", plaintiffs will not be "heard to allege" that a larger amount of oil *is* the equivalent of the "critical proportions". This "question of fact is not open now."

PLAINTIFFS' ALLEGATIONS IN THE HYDE CASE AND IN THIS CASE AS TO THE QUANTITY OF OIL WHICH CHARACTERIZES THEIR PROCESS ARE FLAGRANTLY INCONSISTENT.

The allegations of plaintiffs' witnesses and counsel in the Hyde case and in this case on the central fact as to the quantity of oil which characterizes their process are flagrantly inconsistent. In the Hyde case they alleged that the use of a small fraction of 1% produced results which were *essentially different* from those produced by the use of any larger quantity of oil; and it was because this Court believed these allegations that it sustained their patent; but in doing so this Court was careful to limit the patent to the use of such "critical proportions" of oil. In this case they allege that the use of larger quantities of oil produce results which are *substantially the same* as those produced by the use of a small fraction of 1%; and on this allegation they ask this Court to find the defendant an infringer when it uses more than 0.5% and even more than 1% of oil. If they were right in the Hyde case, they must be wrong in this case. If they are right in this case, they must have been wrong in the Hyde case; and, furthermore, in that event the decision of this Court was based on a misapprehension of the central fact

of the case. It would produce an intolerable situation if the plaintiffs, after having *sustained* their patent in this Court on the theory that more than the critical proportions of oil will produce *substantially different* results, should now be permitted to hold defendant as an *infringer* on the theory that they will produce *substantially the same* results.

Believing the allegation of our adversaries that only the "critical proportions" described in the specifications and in the testimony of the witnesses would produce THE froth of the patent, and sustaining the patent by reason of that belief, this Court was careful to specifically and rigidly limit the patent to the use of these proportions of oil. What plaintiffs' counsel ask this Court to do now is to wipe out the specific limitation which it imposed on their patent as a condition to sustaining those claims which were sustained.

In condemning claims 9, 10 and 11 this Court had before it the very argument which is presented to this Court as a reason why it should stretch the other claims to cover defendant's practice when it uses quantities of oil above the "critical proportions". In plaintiffs' main brief before this Court, in the Hyde case (p. 55), counsel said:

> "Claim 9 is the broadest claim. The amount of oil is stated to be 'a small quantity.' The process is stated to include 'coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth.' The essentials of agitation of the ore in powdered form diffused in water in the presence of a small quantity of oil, so as to form a froth and thereby to utilize air bubble separation, are set forth, as well as the completion of the operation of concentration or separation by separating the froth. The novelty of the invention as thus defined is unquestionable. *Conditions may well arise in the future wherein the critical oil*

proportion is increased by reason of a useless absorption of the oil within the pores of a gangue material, or wherein an oil or a mixture of oils is employed having unusual characteristics, as a result of which the critical oil proportion may be one per cent. or slightly more. Under such conditions this and the two following claims may be necessary to protect the invention."

It was with this argument before it that this Court in effect said: "No; you are not entitled to those claims 9, 10, and 11, because they are too broad. The full extent of the monopoly you are entitled to is the use of oil in the 'critical proportions.' Beyond these proportions lies the public domain."

In other words, the condemnation of this Court of claims 9, 10 and 11, in view of the arguments presented on behalf of the plaintiffs, is a direct and final answer to the plaintiffs' contentions in this case.

PLAINTIFFS' CONTENTION THAT PETROLEUMS ARE NOT AMONG THE "OILS OR OILY SUBSTANCES" OF THE PATENT IN SUIT AND SHOULD NOT BE CONSIDERED IN DETERMINING THE AMOUNT OF OIL USED BY DEFENDANT IS A BRAND NEW CONTENTION AND IS CONTRADICTED OVER AND OVER AGAIN OUT OF THE MOUTHS OF PLAINTIFFS AND THEIR WITNESSES IN THE HYDE CASE AND IN THIS CASE.

Defendant uses mixtures of oils and while the mixtures have varied, that which has been taken by both sides as typical, is the following: 24% pine oil, 65% fuel oil and 11% kerosene. Since fuel oil and kerosene differ only in specific gravity, both being petroleum, we may simplify the formula by saying that the mixture is composed of 24% pine oil and 76% petroleum—or, substantially, one part vegetable oil to three parts petroleum.

Plaintiffs' counsel say that the petroleum constituent

of defendant's mixture of oils is "inactive" or "ineffectual" in the process and should not be considered as the "oil" of the claims in determining the question of infringement. *Defendant denies that the petroleum constituent of its mixture of oils is inactive or ineffectual in the process.*

This raises a pure question of fact which was fully considered by the Court of Appeals and, after studying the evidence and witnessing experiments, that Court found the fact to be that the petroleum constituent of defendant's mixture is *not* inactive in the process; and that, therefore, it should be considered as the "oil" of the claims in determining the question of infringement. The Court of Appeals was never asked by the defendant to find, and it did not find, that anything inactive in the process should be included in determining the amount of "oil" used.

The testimony of the witnesses (plaintiffs', as well as defendant's) and the testimony of its own senses, made it quite impossible for the Court of Appeals to find otherwise than that the petroleum constituent in defendant's mixture of oils is active in the process.

The first question is, Are petroleums among the "oils or oily substances" referred to in the specifications and claims of the patent in suit?

Crude petroleum as it comes from the wells is divided by what is termed "fractional distillation" into various grades, which are known in commerce as "gasoline", "kerosene", "fuel oil", "lubricating oil" and "residuum". That is to say, when crude oil is heated to say, 350° F., a certain amount of vapor is driven off and that vapor when condensed is sold as "gasolene". When the remainder is heated to say, 600° F., a certain additional amount of vapor is driven off and that vapor when condensed is sold as "kerosene". When the remainder is heated to certain higher temperature, an additional

amount of vapor is driven off and that vapor when condensed is sold as "fuel oil". Higher temperatures yield "lubricating oil". That which is left after the "lubricating oil" has been distilled off is known as "residuum". These several grades differ from each other, therefore, only in their boiling points.

(*a*)

In the first place, in the specifications the "oily liquid" of the claims is defined (p. 1, line 12) as "oils, fatty acids, or *other substances which have a preferential affinity for metalliferous matter over gangue.*"

When we come to the claims we find that they call for *"an oily liquid having a preferential affinity for metalliferous matter."*

Hence we see that any oily liquid having a *preferential affinity for metalliferous matter over gangue* is included within the term "oily liquid" in the claims.

Plaintiffs admit that petroleum oils have such "preferential affinity for metalliferous matter".

Petroleum oils, therefore, fall strictly within the language of the claims of the patent in suit.

(*b*)

In the second place, the patent in suit immediately after referring in terms to the prior Cattermole patents says (specifications p. 1, line 28):

"We have found that if the proportions of oily substance be considerably reduced," etc., the results of the patent in suit will be realized. This refers us directly to the said Cattermole for information as to what are the "oily substances" referred to, and going there we find (Tr. Vol. III, p. 1282, line 89), the "oily substance" described as follows:

> "The 'oil' used may be animal, vegetable or *mineral* oil or *mixtures of these* or such coal or

> wood tar products or other substances which exercise, like oils, *a preferential physical affinity for metallic mineral matter as distinguished from gangue.*"

Further on, the specifications of the patent in suit say (p. 1, line 61):

> "The proportion of mineral which floats in the form of froth varies considerably with different ores and *with different oily substances,* and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine *which oily substance* yields the proportion of froth or scum desired."

When we come to the claims we find that they define the oil as *"an oily liquid having a preferential affinity for metalliferous matter,"* and see that this phrase is practically word-for-word the language used in the Cattermole patent.

It is plain, therefore, that the specifications of the patent in suit, by their reference to the prior Cattermole patents and the adoption of the language of those patents in describing in the claims the "oil or oily substance" to be used, directly include among those substances *"mineral"* oils and *"mixtures"* of the same with other oils. "Mineral" oil is, of course, petroleum.

(*c*)

In the third place, the patentees Sulman and Picard in their report of May 5, 1905, to the Chairman of Minerals Separation, which was the first written description of the invention at bar, said (Tr. Vol. II, p. 665):

> "We may here conveniently note that *other oils* besides oleic acid may be employed in this modified recovery process, but *so far as Broken Hill is concerned,* Oleic acid gives by far the best results. *Petroleum residuum* added as emulsion, *paraffine*

oil alone, R_3P_1 and R_1P_3 emulsions, have also been used, and *all give small proportions of float,* but do not act nearly so vigorously or efficiently *on Broken Hill ores* as plain Oleic acid."

"Paraffine oil" is the English name for kerosene, and the symbol "R_3P_1" means a mixture of petroleum residuum three parts, and paraffine oil one part; while the symbol "R_1P_3" means a mixture of petroleum residuum one part and paraffine oil three parts (Tr. Vol. I, p. 264, Rd-Q. 241). These emulsions were, therefore, composed entirely of petroleums.

We see, therefore, that at the birth of the invention it was recognized that petroleums were among the substances that could be used in effecting the desired results; but it was noted that with the particular ore that they were then treating (Broken Hill) and with the particular petroleum mixture selected, they did not give as good results as oleic acid. We shall now show that shortly thereafter these patentees found that another petroleum oil (to wit: petrol or gasoline) did give as good results as oleic acid with Broken Hill ore.

(*d*)

In the fourth place, the British patent corresponding with the patent in suit, in the Complete Specification (Tr. Vol. II, pp. 780 to 784) repeatedly states that *"petrol"* (which is the English name for gasoline), is the equivalent of oleic acid in this process. These complete specifications, wherever they mention oleic acid, always mention "petrol" as an equivalent. Once on page 781 it speaks of "oleic acid or *petrol, or other suitable oil";* three times on pages 781 to 782 it speaks of "oleic acid, *petrol, etc.";* in the claims on pages 783 and 784 it speaks of "oleic acid or *petrol".* This Complete Specification is substantially word-for-word like the specifications of the patent in suit, except for the fact that wherever it men-

tions oleic acid it also mentions "*petrol*". A comparison of this Complete Specification with the Provisional Specification of the same patent (Tr. Vol. II, pp. 778 to 780) is instructive. The Provisional Specification, unaccompanied by drawings, was filed April 12, 1905, and does not mention *petrol* specifically. The specification of the patent in suit was filed in this country about six weeks later (May 29, 1905) and it is practically a word-for-word copy of the British Provisional Specification so far as it goes. The Complete Specification of the British patent was filed later (to wit: June 3, 1905), and in this wherever oleic acid is mentioned *petrol* is mentioned as an equivalent. From these facts, it is evident that after the Provisional Specification was filed, and after the application papers for the United States patent were mailed to this country, and before the Complete Specification was written, the patentees had tried "*petrol*" (*i. e.*, gasoline) on Broken Hill ore, and had found that it was completely successful. As we shall show later, Higgins, the experimenter for Minerals Separation, by his testimony confirms this conclusion.

(*e*)

In the fifth place, Sulman, one of the patentees of this patent in suit, subsequently obtained a patent No. 835,143, in which he refers to the patent in suit and says (Tr. Vol. III, p. 1309, line 15):

> "In the process described in the specification of the previous patent application, Serial No. 262,889, filed May 29, 1905, a mineral pulp is agitated with a small proportion of an oily substance, such as oleic acid *or petrol or other oil*, amounting to a fraction of one per cent. on the ore," etc.

The "specification of the previous patent application" there referred to is the specification of the patent in suit. This Sulman application was filed (October 20, 1905) before the patent in suit issued (November 6, 1906).

(*f*)

In the sixth place, several of the prior patents relied on by defendant as anticipations and referred to by this Court in its decision in the Hyde case, describe the use of petroleum products as the mineral selective agents to be used. If petroleum products had not been, in the opinion of plaintiffs, among the "oils or oily substances" referred to in the specifications and claims of the patent in suit, they would have disposed of these prior patents by the simple statement that petroleum products were not the equivalents of oleic acid for the purposes of the invention. Instead of doing that, they admitted, as this Court found, that these prior processes differed from the process at bar, not in the fact that they failed to describe oily substances suitable for the purpose, but in the fact that they failed to describe the use of the critically minute quantities of oil to which this Court limited the field justly covered by the patent in suit.

Thus, the prior art Everson patent describes, among others, the use of *"petroleum* and one of its several constituents—namely, *paraffine oil"* (Tr. Vol. III, p. 1209, lines 81 to 83). "Paraffine oil" is another name for kerosene.

Thus, the oily agent described in the prior art Glogner patent is *"petroleum"* (Tr. Vol. III, p. 1262, lines 23, 24).

Thus, the oily agent described in the prior art Kirby patent is *"kerosene"* with bitumen dissolved in it (Tr. Vol. III, p. 1316, lines 16, 17).

Thus, the prior art Schwarz patent describes the use of *"mineral oils"*, among others (Tr. Vol. III, p. 1294, lines 63, 64).

Thus, the prior art Cattermole patent describes the use of *"mineral* oil" and "mixtures of these" with other oils (Tr. Vol. III, p. 1282, line 90).

So it was very common in the prior art to use as the oily agent in ore concentration petroleums and mixtures of these with other oils. If petroleums were not among

the "oils or oily substances" of the patent in suit, or if when used in mixtures they should not be counted in determining the amount of oil used, plaintiffs' counsel would have pointed out that fact in the Hyde case. Instead of so doing, as we shall show, they put their expert witness, Professor Chandler, on the stand to state affirmatively that petroleums were among the "oils or oily substances" referred to in the specifications and claims of the patent in suit.

(*g*)

In the seventh place, as we have said, Minerals Separation in the Hyde case put its expert witness, Professor Chandler, on the stand and elicited from him in direct examination the affirmative statement that, in his opinion, petroleum products are included within the term "oily substance" in the patent in suit. He said he considered the word "oily" in the patent in suit as equivalent to the word "'greasy' in common language", and that since petroleum products, as well as fatty acids and essential oils, are greasy, he considered that petroleum products, as well as fatty acids and essential oils, are included within the term "oily substance" in the patent in suit (Tr. Vol. I, p. 192, x-Q. 21).

(*h*)

In the eighth place, in the Hyde case plaintiffs' engineers stated, over and over again, that in the practice of the process of the patent in suit, petroleums were used by them either alone or in combination with other oils.*

*It is repeatedly stated in the brief for plaintiffs that in the Hyde case other oils than oleic acid were not considered. It is true that other oils were not considered on the question of infringement, because the defendant in the Hyde case used oleic acid. It is not by any means true, as shown in the following pages of this brief, that in the Hyde case the fact that other oils, including petroleums, could be used alone, or in mixtures, in the practice of the process of the patent in suit, and were included within the term "oil or oily liquid" in said patent, was not a fact before this Court.

Thus:

Plaintiffs' engineer, Higgins, said in the Hyde case that in the practice of the process of the patent in suit he had obtained satisfactory results using *"petrol,* certain portions of the distillate of *crude petroleum,* such as *Cosmos oil,* vegetable oils, such as palm oil, cottonseed oil, linseed oil and animal oils, such as lard oil and oils squeezed from beef fat" (Tr. Vol. II, p. 1062, Q. 110). "Cosmos oil" is a petroleum sold for lubricating purposes (Tr. Vol. II, p. 1063, Q. 121) and "petrol" is the English name for gasoline (Tr. Vol. II, p. 1063, Q. 113).

Plaintiffs' engineer, Chapman, said in the Hyde case that in practicing the process of the patent in suit at Broken Hill, Minerals Separation used a mixture of oleic acid and "Karsam soap which is a *petroleum* soap", in quantity slightly over 0.1% on the ore (Tr. Vol. I, pp. 242, 243, Qs. 94 and 96). This witness also said that in practicing the invention of the patent in suit at the Braden Mine in Chili, Minerals Separation used a mixture of three parts Texas *fuel oil* and one part American wood tar oil in quantities of 0.2% of the mixture (Tr. Vol. I, p. 245, Q. 112). "Texas fuel oil" is a petroleum. It will be observed that the mixture used there was the same mixture that defendant is now using, *i. e.,* three parts petroleum to one part vegetable oil.

Plaintiffs' expert witness, Dr. Liebmann, said in the Hyde case that in practicing the process of the patent in suit he had used besides oleic acid "cottonseed oil, viscous valve oil, palm oil, lard oil, pinnoline, linseed oil, eucalyptus, Texas *residue oil,* turpentine". Of these, "Texas residue oil", is a petroleum.

All the above testimony was before this Court in the Hyde case.

In the present case, plaintiffs' engineers have given further evidence to the fact that Minerals Separation and its licensees largely use mixtures of oils containing petroleum, in one form or another, as a constituent, and

in quantities in the neighborhood of 0.1% of the mixture. Thus:

Greninger, employed by Minerals Separation American Syndicate in demonstrating and installing flotation plants in this country and in Canada (Tr. Vol. V, p. 2263, Qs. 2 to 7), says that after experimenting with numerous oils, the Inspiration Company finally adopted as standard "wood-tar oil known as Stockholm tar, mixed with certain *mineral oils*" in quantities in the neighborhood of 1% on the ore (Tr. Vol. V, p. 2264, Q. 14 and Q. 17). "Mineral oils" are, of course, petroleums. This witness also says that when employed by the Minerals Separation he used "a large number of oils" among them "cresylic acid and Stockholm tar and various *mineral oils, fuel oil*" (Tr. Vol. V, p. 2272, x-Q. 116). "Mineral oils" are, of course, petroleums, and "fuel oil" is what is left in the still after the gasoline and kerosene have been distilled off (Tr. Vol. V, p. 2272, x-Q. 117). This witness also says that at the Britannia Company in British Columbia he used as the standard a mixture of which 75% was *petroleum* and 25% was wood tar oil (Tr. Vol. V, p. 2272, x-Qs. 119 to 123). In this case, it will be observed three-quarters of the mixture was petroleum and one-quarter was vegetable oil, so it was precisely the same mixture that defendant is now using.

Plaintiffs' engineer, Chapman, says in this case that at the Consolidated Arizona Mill he used as a standard a mixture of 50% *stove oil* and *fuel oil* and 50% Carolina turpentine, in quantities of about 0.1% to 0.15% on the ore (Tr. Vol. V, p. 2292, Qs. 33 to 40). "Stove oil" and "fuel oil" are both petroleum (Tr. Vol. V, p. 2297, x-Qs. 83 and 84). This witness also says he used stove and fuel oil at Anaconda (Tr. Vol. V, p. 2300, x-Qs. 124 and 125). This witness further says concerning petroleum (Tr. Vol. V, p. 2459, Q. 38):

> "I have on many occasions used inactive oils, particularly those like fuel-oil, kerosene and stove-

> oil to produce a *condition of froth* in the Spitz box that will maintain a steady condition of overflow. The addition of these re-agents in small quantities is *extremely useful* for this purpose, and considerably eases up the operating work."

Plaintiffs' witness Higgins further says in this case that petroleum (fuel-oil and kerosene), when used with a vegetable oil are useful in the process in the patent in suit for the purpose of *"preventing the coarse mineral from falling out of the froth"* (Tr. Vol. V, p. 2612. Qs 39 and 40); that it prevents "showering"—that is, it helps to keep the mineral from falling out of the froth (Tr. Vol. V, p. 2545, Qs. 421 and 422).

Atwater, a licensee of Minerals Separation, says he used as a standard on Butte & Superior ore, a mixture of "pine oil, tar oil, hard-wood creosote, sludge acid and some *kerosene*" in quantities of about 0.15% of the mixture (Tr. Vol. V, p. 2309, Qs. 45 and 46).

Wiggin, employed by the Anaconda Company, a licensee of Minerals Separation, says that the best mixture was shown by test to be composed of *"kerosene,* sludge acid, wood creosote, and *stove oil"* (Tr. Vol. V, p. 2384, "2"). "Stove oil" is, as we have said, petroleum.

The testimony of defendant's witnesses shows that prior to the decision of this Court in the Hyde case, when non-licensees were using oil in quantities of about 0.1% on the ore, they generally used mixture in which petroleum was a constituent. Thus:

Wicks, employed by the Chino Copper Company, says that between December, 1914, and December, 1916, when they were using about 0.1% on the ore, they used at one time a mixture composed of "80% California *crude oil* and 20% pine oil" (Tr. Vol. III, p. 1447, Q. 29), and at another time "70% *Texas No. 4 oil* and 20% creosote oil and 10% pine" (Tr. Vol. III, p. 1448, Q. 31). "California crude oil" and "Texas No. 4 oil" are petroleums;

and it will be observed that by far the greater part of the mixtures are made up of these oils.

Conrads, employed by the Utah Copper Company, says that in 1915 and 1916 they were using, where they were using about 0.1% on the ore, they used mixtures of which *Jones oil* was a constituent (Tr. Vol. III, p. 1584, x-Q. 267; p. 1585, x-Q. 279). "Jones oil" is a petroleum.

The Conflict of Testimony Concerning the Frothing Qualities of Petroleums.

There is no conflict of testimony concerning the fact that petroleums in mixtures are useful. There could not possibly be any conflict of testimony as to this, in view of the fact that we have already shown (*supra*, pp. 69-70) plaintiffs' engineers admit that petroleums alone and in mixtures have been found to be useful, and we have already shown (*supra*, p. 70) that plaintiffs' engineer, Higgins, says he has obtained satisfactory results using petrol alone and Cosmos oil alone.

Notwithstanding these admissions, it is now contended that petroleums are not "frothing oils". Whether they are "frothing oils" or not, so long as they have, as it is admitted they have, a "preferential affinity for metalliferous matter", as required by the specifications and claims of the patent in suit, and so long as they, alone or in association with other oils, assist in effecting concentration, as it is admitted they do, it is, we submit, a matter of no moment whether they are "frothing oils" or not.

The term "frothing oil" is an indefinite and elastic one. Some oils produce under given conditions more froth than other oils. Oil A under certain conditions will produce more froth than oil B; but under other conditions oil B will produce more froth than oil A. So,

under certain conditions, oil A will be more selective than oil B, and under other conditions oil B will be more selective than oil A. Besides, different samples of the same oil will behave differently. For example, some samples of kerosene will produce a voluminous froth, while other samples of kerosene will produce but little froth, and these latter will be spoken of as "non-frothing oils". Thus, Professor Sadtler states (Vol. V, p. 2638, answer to Q. 6):

> "A. I have had experience in the past with the frothing of kerosene or kerosene supposed to produce a mineral froth, and I do not agree with the unqualified statement that kerosene is not a frothing oil. Some kerosenes that I have tried cannot be made to raise a froth with the flowing ore pulp. Other kerosenes do. In tests and experiments made several years ago, I tested Pennsylvania kerosene, California kerosene, Oklahoma kerosene, and Texas kerosene, and in three cases out of four I was able to produce excellent mineral froths with kerosene. With some of them I did not obtain any results. So I am of the opinion that many kerosenes, absolutetly free from any foreign mixture—and I should say that one of these California oils that I mentioned, California kerosenes, I made myself in my laboratory direct from the California crude oil by distillation of the kerosene fraction, the treatment of the same with acid and steam stilling to clear it of light vapors, so that I had a standard kerosene fraction made from California petroleum that I could vouch for as being the genuine kerosene fraction of that crude oil. That kerosene is a good frothing agent, gave me excellent mineral froths. These results were gotten in June, 1914."

Just why these things are so nobody knows and probably nobody will know until scientists agree as to the whys and wherefores of frothing and selectivity. At the present time, as the record in this case shows, scientists

are far from being in agreement as to the essential laws underlying these phenomena.

What is true of kerosene is true of other oils. It is true even of oleic acid. This was forcibly illustrated at the trial of this case before Judge Bourquin when plaintiffs' chief experimenter, Higgins, attempted to demonstrate in Court the process of the patent in suit applied to defendant's ore using 0.1% oleic acid. The attempt was made on May 11, 1917. The experiment was conducted in a Gabbett mixer with a speed of about 850 to 900 revolutions per minute, the agitation being continued for three minutes. The result was that no froth was produced and the experiment was a complete failure. Counsel at the time explained the failure by saying that the belt was slipping and that hence the agitation was insufficient (Tr. Vol. V, p. 2508). Three days later (May 14, 1917) Higgins again attempted to make this demonstration, explaining the cause of the previous failure by saying that sulphuretted hydrogen was evolved, to counteract which he added copper sulphate. Again he scored a complete failure, although he said he had successfully performed the experiment in the interim (Tr. Vol. V, p. 2613, Qs. 57 to 68). He explained the failure by saying that he had not used enough copper sulphate and, after adding more copper sulphate, he again attempted to make the demonstration. Again he failed (Tr. Vol. V, p. 2614, Qs. 67 to 69). He then added still more copper sulphate and again failed to obtain any satisfactory results (Tr. Vol. V, p. 2615, Qs. 70 to 76). He then took a new sample of ore and attempted to make the demonstration in another machine (the Slide Machine) but got no better results (Tr. Vol. V, p. 2616, Qs. 78 to 81). Finally he took a sample of defendant's ore which he had received in 1912 or 1913 and with this he scored a success (Tr. Vol. V, p. 2617, Qs. 84 to 86).

These series of failures by Higgins when he was trying to succeed show how easy it is to score a failure with prior art processes when a failure is desired. Further confrmation of this fact appears in the record in connection with attempted demonstrations made by Minerals Separation in connection with the litigation in the English Courts, to which reference has frequently been made in this case. It appears that Minerals Separation attempted to demonstrate the process of the patent in suit in the presence of their adversaries in that case, and that this was done in their laboratory in London with all the facilities which their laboratory afforded. Instead of producing a froth as was intended, they produced principally what plaintiffs call "skin flotation." Their expert, Ballantyne, who was present, explained the failure by saying that the size of the spitzkasten was too large for the amount of ore used—a subject concerning which the patent in suit is entirely silent (Tr. Vol. I, p. 306, Q. 56).

When it is difficult to succeed when one wishes to succeed, how easy it is to fail when one wishes to fail. While discussion of the prior art processes is, at this time, practically foreclosed, we cannot help saying that we think the Court erred in giving the same and even greater consideration to plaintiffs' failures with prior art processes than it did to defendant's successes with the same processes. One success will outweigh any number of failures. As Mr. Justice Bradley said in *Loom Co.* vs. *Higgins,* 105 U. S. 580, 586:

> "When the question is, whether a thing can be done or not, it is always easy to find persons ready to show how not to do it."

That the petroleum part of a mixture of oils is not inert but plays its part in the production of froth, is further completely demonstrated by the records of full

mill operations at the Arthur Plant of the Utah Copper Company, testified to by the witness Janney (Tr. Vol. III, p. 1515, Q. 59 *et seq.*). The records referred to appear in Defendant's Exhibit 31 (Tr. Vol. VI, following p. 2736). In one case at this plant they used more than 1% (20.33 pounds per ton) of a mixture composed of petroleum 89% and vegetable oil 11%. In another case they used the petroleum part of this mixture alone. In another case they used the vegetable oil part of the mixture alone. The records show that the petroleum part of the mixture when used alone gave a higher extraction than did the vegetable oil part of the mixture when used alone. They also show that the complete mixture gave a higher extraction than did either of its parts when used alone, as we should expect. These mill operations demonstrated that the petroleum constituent of the mixture was more active and useful than the vegetable oil constituent of the mixture. A detailed explanation of these experiments carried on as full mill operations follows: In one run (Experiment No. 7) the oil used was 20.33 pounds per ton, it being composed of 89% petroleum (30% Jones fuel oil and 59% smelter fuel oil) and 11% of vegetable oils (10% American creosote and 1% of Yaryan pine oil). In this run the extraction was 98.41% and the tailings carried only 0.076% copper. The actual amount of petroleum per ton used in this experiment was 18.1 pounds—being 89% of 20.33 pounds; and the actual amount of vegetable oils per ton used was 2.23 pounds—being 11% of 20.33 pounds. In another run (Experiment No. 20) substantially the same amount (17.84 pounds) of the same petroleums was used. In this case the extraction was 95.06% and the tailings carried 0.306% copper. In another run (Experiment No. 17) substantially the same amount (1.97 pounds) of the same vegetable oils were used. In this case the extraction was only 85.72%

and the tailings carried as much as 0.81% of copper. The results are summarized thus:

SUMMARY:

	Extraction	Copper in Tailings
Mixture petroleums and vegetable oils	98.41%	0.076%
Petroleum part alone	95.06%	0.306%
Vegetable oil part alone	85.72%	0.81%

Further, in direct contradiction of the theory that petroleum when used in a mixture with vegetable oil is inactive and plays no part in the production of foam, Wicks described what happened one day in the mill of the Chino Copper Company when in the course of regular mill operations they were using 1.6% (32.27 pounds per ton) of a mixture composed of petroleum and vegetable oil. The mill had been running four or five hours with satisfactory results, and, while the witness was watching the spitzkasten, unexpectedly "the froth apparently disappeared right off the surface of the machine and the separation of the finer particles ceased, practically,—there were some, but practically none". He sent a workman down to investigate and found the only thing had happened was that the pump supplying the petroleum part of the mixture had been shut down, although the supply of the vegetable oil part of the mixture was being continued right along (Tr. Vol. III, p. 1454, Qs. 87 to 91).

Defendant's witness Punchon describes similar occurrences intentionally produced in the regular course of mill operations at the Arthur plant, where a mixture of vegetable and mineral oils like that used by defendant was being emplyoed. He says (Tr. Vol. IV, p. 2166, Q. 8 to Q. 20) that when the supply of mineral oil was cut off the froth gradually died away in the spitzkasten and selective action ceased.

Further, defendant's witness, Dosenbach, made an

experiment before the District Court, using 25% kerosene or petroleum distillate and agitating it in the square-glass-jar machine. He obtained "a very copious highly-mineralized froth" (Tr. Vol. IV, p. 1893, Q. 58 to p. 1895, Q. 61). Not only did he obtain such a froth and give samples of it to the other side, but he produced an analysis of it. The experiment is known as No. 32, and the analysis appears in Defendant's Exhibit No. 304 (Tr. Vol. VI, following p. 3082, opposite the title "Kirby, Test No. 32"). The ore used was Utah copper containing 5.87% copper, 6.76% iron and 75.4% gangue ("Insol."). The assay of the concentrate showed that it contained 23.94% copper, 23.5% iron and 21.0% gangue ("Ins."). By this process, therefore, the copper content was raised from 5.87% to 23.94%, and the iron content was raised from 6.76% to 23.5%. Adding these figures together we see that the mineral content was raised from 12.63% to 47.44%, while the gangue content was reduced from 75.4% to 21.0%.

Plaintiffs' counsel insinuate that these experiments were dishonest. They characterize them as "spurious experiments", and they speak of the "exposure" of the deceit.

The fact is, the kerosene used in these experiments did contain a trace—a mere trace—of something soluble in water, which may have been, we admit, pine oil. The first important question is: Was it there by design or was it there by accident? The next important question is: Was it present—assuming it to have been pine oil—in sufficient quantity to account for the successful results of these experiments?

The answer to the first question will justify the insinuations of plaintiffs' counsel, or will dispose of them once and for all.

There is no question whatever but that the soluble substance present in the kerosene was there by accident and

not by design, and that its presence was not suspected by defendant's witness when they performed their experiments in Court. Higgins discovered the presence of this "small amount" of contaminant, but it was so small in amount that he admitted they were "not able to isolate it" (Tr. Vol. V, p. 2552). Later Sadtler analyzed the kerosene carefully and found it to contain *twelve one-thousandths of one per cent.* (0.012%) of something soluble in water (Tr. Vol. V, p. 2643, Q. 11). Previously Dosenbach had been cross-examined about this kerosene, and had stated that nothing had been added to it after it was purchased (Tr. Vol. IV, p. 2187) and that, so far as he knew, it was not "contaminated in any way with other oils" (x-Q. 155); but that (x-Q. 149)

> "Sometimes we have no tanks available and we have to use a tank that has contained other oils, but then that is very seldom. It is quite a hard problem to take care of all these different oils that come in, and it is necessary sometimes to put the kerosene, as well as other oils, into tanks that have contained different oils."

That in practice defendant cannot provide brand new tanks for each new kind of oil received, and that it must and does put oil when received into whatever empty tanks are available, without reference to what kind of oil the tank has held before, is too obvious to require testimony to prove it. What may have happened was that the kerosene in question had been put into an empty tank which had previously contained another oil (possibly pine oil), which explains the presence of such an oil in a quantity which amounted to a mere trace. There is no reason whatever to doubt Dosenbach's statement that he believed the kerosene employed in the experiments was free from even a trace of contaminant. This simple explanation completely disposes of the insinuations of bad faith aimed at our witnesses.

The only remaining question is whether this contaminant—assuming it to be pine oil—existed in the kerosene in sufficient quantity to account for the successful results of the experiments. As we have said, Sadtler found in the kerosene twelve one-thousandths of one per cent. (0.012%) of water-soluble substance. In the experiments 25% of kerosene on the ore was used. Hence the amount of pine oil (if it was pine oil) on the ore present was one-quarter of twelve one-thousandths of one per cent. It was, therefore, *three one-thousandths of one per cent.* (0.003%) on the ore—a mere trace of a trace of pine oil! Will anybody contend that 0.003% of pine oil on the ore will produce any substantial effect? We think not. At least no one has as yet advanced such a contention, while defendant's witness, Janney, says affirmatively that he has examined about 1,200 oils and fractions of oil and has never found one which would be effective in quantities as little as 0.003% on the ore (Tr. Vol. V, p. 2649, Qs. 5 to 10). Then, with what reason do the plaintiffs ask the Court to throw out of the case these experiments, especially when Sadtler was prepared to repeat them with the same kerosene oil freed from contaminant, and was prevented doing so by the strenuous objection of our adversaries (See Tr. Vol. V, pp. 2638 to 2643)? Our witnesses did not know that the kerosene used by them in the experiment was contaminated by a trace of another oil. When that fact was developed by the testimony of plaintiff's witnesses, it was a complete surprise to our side; and we should have been permitted to repeat the experiments with purified kerosene, if anybody really thought that the presence of this trace of a trace of soluble oil was responsible for the successful results produced. Verily our adversaries have been reduced to the necessity of catching at mere straws and objected to having the flotation capacity of this particular straw exposed.

The trial Court, we submit, erred in refusing permis-

sion to repeat said tests, but since it is proved and not denied that so little as 0.003% of any oil could not have had any substantially beneficial effect, the error is not material.

It is perfectly true that some kerosene oils can be found which will not produce a froth, for, as Dr. Sadtler said (Tr. Vol. V, p. 2638, Q. 6):

> "Some kerosenes that I have tried cannot be made to raise a froth with the flowing ore pulp. Other kerosenes do. In tests and experiments made several years ago, I tested Pennsylvania kerosene, California kerosene, Oklahoma kerosene, and Texas kerosene, and in three cases out of four I was able to produce excellent mineral froths with kerosenes. With some of them I did not obtain any results. So I am of the opinion that many kerosenes, absolutely free from any foreign mixture—and I should say that one of these California oils that I mentioned, California kerosenes, I made myself in my laboratory direct from the California crude oil by distillation of the kerosene fraction, * * * so that I had a standard kerosene fraction made from California petroleum that I could vouch for as being the geuine kerosene fraction of that crude oil. That kerosene is a good frothing agent, gave me excellent mineral froths. These results were gotten in June, 1914."

This testimony was not contradicted and does not conflict with the experience of plaintiffs' witnesses, who tried samples of kerosene which would not produce a froth.

Plaintiffs' Experiments in this Case Before the Court of Appeals, Intended to Show that Kerosene was Not a Frothing Oil, in Fact Resulted in the Production of Excellent Froths.

Finally, experiments were made in the presence of the Court of Appeals by plaintiffs' experts designed to show that petroleum (particularly kerosene) would not produce a froth. These were repetitions of the so-called

"bar-mixer" experiments made by Higgins in the Court below, designed and alleged to prove that petroleum would not produce any froth. What happened at that time was described in a foot-note to the printed report of the arguments of defendant's counsel handed to the Court after the hearing, and while this foot-note resulted in plaintiffs' counsel filing a supplemental brief, that supplemental brief did not deny the accuracy of the statements, as to the production of froths, in the experiments before the Court of Appeals, although, of course, it denied that the froths were the "same". Even this denial is immaterial because since it is admitted that petroleum has a preferential affinity for metal over gangue, it necessarily follows that froth, if produced, would affect concentration. That foot-note reads as follows:

> "After the argument certain experiments were made in Court by plaintiffs in *bar-mixers* for the purpose of proving that the *mineral-oil* constituent of defendant's mixture when used alone will not produce a froth with defendant's ore. These were criticised by us because the volume treated in a bar-mixture is so small and the depth of liquid so insignificant that the foaming qualities of the contents is very largely masked and affords no fair indication of what happens in commercial machines.
>
> "In the first bar-mixer experiment (called No. 6) 0.1% of *kerosene alone* was added to defendant's ore. After agitation the Court observed that an *excellent froth* was produced. There then was added to what was already in the bar-mixer, 0.1% of pine oil; and after agitation the Court observed that the same froth as before was produced, but its amount was somewhat increased. This experiment completely disproves plaintiffs' contention that *kerosene alone* will not produce a froth, and will not in a mixture contribute to the production of froth.
>
> "In the second bar-mixer experiment (called No. 7) there was added to defendant's ore a mix-

ture of *Jones' fuel oil and kerosene* in the proportion in which these oils are used in defendant's mixture, and in an amount equivalent to that present in defendant's machines, so there was in the bar-mixer the entire mineral-oil constituent of defendant's mixture. After agitation the Court observed that an *excellent and voluminous froth* was produced. This experiment completely disproves plaintiffs' contention that the mineral-oil constituent of defendant's mixture does not produce a froth with defendant's ore, and completely establishes what we offered to show (but were not permitted to show) that in our commercial machine (the Janney machine) the mineral-oil constituent of defendant's mixture will produce voluminous froth with defendant's ore. Finally, there was added to what was already in the bar-mixer, 0.2% of pine oil, which is the amount present in defendant's mixture, and after agitation the Court observed that the same froth as before was produced, but the amount was somewhat increased.

"In the third bar-mixer experiment (called No. 8) *25% of kerosene* was added to defendant's ore, and after agitation the Court observed that an *excellent and voluminous froth* was produced. Subsequently there was added to what was already in the bar-mixer 0.1% of pine-oil; and after agitation the Court observed that the same froth as before was produced, but its amount was somewhat increased. The froths produced in this experiment did not differ from the froths produced in the other experiments, except in that they were more oily in appearance—as they must necessarily be, owing to the fact that a larger proportion of oil was used. This experiment, therefore, disproves the contention of plaintiffs' witnesses that a large percentage of kerosene will not produce a froth, and it verified the statements of defendant's witnesses that it will produce a froth."

Concerning the above statement plaintiffs' counsel in their supplemental brief here (p. 140) state that "it is enough to say of this description that it is inaccurate, in

fact, *untrue*". This is a very serious charge; but as the statement in question was addressed to the Judges of the Court of Appeals who saw the experiments and who knew whether it was or was not true, it was certainly stupid for defendant's counsel to have made an "untrue" statement, and it is certainly strange that plaintiffs' counsel, in filing a reply memorandum on this very question, did not call the attention of the Judges of the Court of Appeals to the fact that the statement was "untrue". At any rate, we call this Court's attention to the fact that plaintiffs' counsel have not denied in their briefs that the petroleum experiments performed by them before the Court of Appeals *did result in the production of froth.*

WHILE IN THE HYDE CASE, AS WE HAVE SHOWN, THE PLAINTIFFS NOT ONLY ADMITTED BUT AFFIRMATIVELY ASSERTED THAT PETROLEUM PRODUCTS WERE AMONG THE "OILS OR OILY SUBSTANCES" OF THE PATENT IN SUIT, YET WHEN DEFENDANT HERE USES A MIXTURE ABOVE 1% ON THE ORE, CONTAINING PETROLEUM PRODUCTS AS A CONSTITUENT, PLAINTIFFS TURN ABOUT-FACE AND ARGUE THAT THE PETROLEUM CONSTITUENT SHOULD BE DISREGARDED IN DETERMINING THE AMOUNT OF OIL USED.

Plaintiffs' counsel in their brief on the petition for *certiorari* said that the petroleum constituent of mixture used by defendant is used (p. 23):

> "to throw a cloak of disguise over their operations by adding an alien and inoperative oil which does not change the essential character or operation or result of the process and which merely seeks to avoid the letter of the claim while keeping the substance of the invention."

All the foregoing testimony concerning the use and the usefulness of petroleum, alone and in mixtures, was

before this Court in the Hyde case; and yet plaintiffs' counsel said in their brief on the petition for *certiorari* in this case (pp. 19 and 20):

> "fuel oil and kerosene oil, either alone or together, do not function or operate as the oil or oily substance of the process of the patent in suit and do not achieve the results described in the patent and in the opinion of this Court. That such oils would thus fail to operate when an effort was made to use them in the process in suit, did not appear in the evidence in the Hyde case. That such oils could be mixed with mineral-froth-forming oils capable of effectuating the process of the patent in suit and yet not destroy the action of the mineral-froth-forming oils in carrying on the process of the patent in suit was unknown when the evidence in the Hyde case was taken. It was a laboratory discovery made by one of the respondent's employees in the Summer of 1913."

And in a foot-note to page 20 of their brief on the petition for *certiorari* in this case, answering defendant's contention that there is a fatal inconsistency between the contentions of the plaintiffs in the Hyde case on the issue of validity and their contentions in this case on the issue of infringement, they said:

> "But in the Hyde case no such special and peculiar oil mixtures were debated or considered or known as respondent in the instant case has found it possible to employ with its peculiar ore and with agitation of extraordinary violence. No such mixture was disclosed by the prior art in the Hyde case and no such mixture was used in the laboratory experiments there discussed in evidence and in argument. It follows from this that nothing that was there said has any bearing on the present issue of infringement."

We have shown (*supra*, pp. 68-70) that these statements are not at all in accordance with the facts, as

set forth by the testimony of plaintiffs' own witnesses. We have shown, on the contrary, that not only are petroleums among the oils and oily substances referred to in the patent, but that the use of them, and mixtures containing them, was described by witnesses in the Hyde case.

Indeed, when defendant was using oil in quantities in the neighborhood of 0.1% on the ore, it used a mixture of which petroleum was a constituent. Plaintiffs' counsel make a point of the fact that when defendant was using oil in quantities of about 0.1% on the ore, its mixture contained only about 10% Jones oil, which is a petroleum (Tr. Vol. III, p. 1449, Q. 44); whereas, at the present time using larger quantities of oil it is using a mixture containing about 75% petroleum, and it is argued that so large a percentage as this in the mixture indicates an evil intent. We are not able to follow this line of argument, because we have shown that petroleums are as much the oils of the patent as are oleic acid or pine oil, or any other kind of oil. But, as a matter of fact, there is nothing unusual in the use of mixtures containing 75% petroleum, even when the mixture is used in quantities in the neighborhood of 0.1% on the ore. Plaintiffs, themselves, have so used them. Thus:

Plaintiffs' engineer, Chapman, in his testimony in the Hyde case (Tr. Vol. I, p. 245, Q. 112) stated that after making a large number of tests on the ore of the Braden mine in Chili, they adopted a mixture composed of "three pounds of Texas *fuel oil* and about one pound of American wood-tar oil per ton of ore," the amount used being 0.2%. With this mixture he says:

> "We obtained recoveries of eighty-five to ninety per cent. of the copper content in a concentrate assaying ten to fifteen per cent. of copper, the original content being roughly three per cent. of copper. These results have been considerably improved in practice, and the installation of a very

large plant at present, one thousand two hundred tons per day, is now taking place as a result of the trials carried out in a two hundred and fifty ton per day testing unit."

It will be observed that the mixture which plaintiffs themselves adopted and applied to the Braden ore is precisely the same mixture which defendant uses—*i. e.*, a three-to-one mixture of petroleum and vegetable oil—and that the fact such a mixture used in quantities of 0.2% was highly efficient in the practice of the process of the patent in suit was before this Court in the Hyde case.

Again this witness says that at the Consolidated Arizona plant they use as standard a mixture composed of 50% petroleum in quantities of 0.1 to 0.15% on the ore (Tr. Vol. V, p. 2292, Qs. 33 to 40).

Again, plaintiffs' engineer Greninger testifies in this case that he used as a steady thing at the plant of the Britannia Company, British Columbia, a mixture composed of 75% petroleum (Tr. Vol. V, p. 2272, x-Qs. 119 to 123).

And yet when the defendant now uses in quantities above 1% precisely the same mixture which plaintiffs' engineer Chapman found most suitable for the Braden ore and plaintiffs' engineer Greininger found most suitable for the Britannia ore, plaintiffs' counsel allege that the petroleum is used with evil intent and as camouflage and should be disregarded by the Court in determining the amount of oil used by it.

Furthermore, non-licensees in this country, who since the decision of this Court in the Hyde case have used more than 1% of oil, when they were previously using in the neighborhood of 0.1% on the ore, used mixtures containing petroleum as one of its components. This was true of the Utah Copper Company at its Magna plant, and also at its Arthur plant; it was true of the Chino Copper Company; and it was true of the Ray Consolidated Company.

Thus, at the Magna plant of the Utah Copper Company, when using about 0.1% of oil, they always used a mixture of which petroleum (Jones oil) was a constituent (Tr. Vol. III, p. 1584, x-Q. 268; also x-Q. 281, also x-Q. 286). Since they have used more than 1% of oil, they have continued to use Jones oil as a constituent of the mixture (Tr. Vol. III, p. 1586, x-Q. 289).

Thus, the Chino Copper Company, when using about 0.1% of oil, always used a mixture of which petroleum (Jones oil) was a constituent. Since they have used more than 1% of oil, they have continued to use Jones oil as a constituent of the mixture (Tr. Vol. III, p. 1449, x-Qs. 42 to 44).

Thus, the Ray Consolidated Company, when using about 0.1% of oil, they always used a mixture of which petroleum (fuel oil) was a constituent. Since they have used more than 1% of oil they have continued to use fuel oil as a constituent of the mixture (Tr. Vol. IV, p. 1865).

We have said that it is the commonest practice in the art to use mixtures of oils. There is nothing mysterious about this fact. The actions of different oils differ. Some oils are better frothers and some are better selectors. In every case what is sought is the best oils, or combinations of oils, which give just the proper amount of froth (not too little or too much) with the proper degree of selectivity. Most frequently these two results can best be obtained by the use of a mixture instead of a straight oil.

Summary re Contention that Petroleums are Not Among the Oils of the Patent in Suit.

In sum, therefore, we find that petroleum admittedly has a "preferential affinity for metalliferous matter", which is the only specified requirement of the specifications and claims of the patent in suit (*supra*, p. 64); we find that it is one of the oils described in the prior

Cattermole patents, to which the patent in suit directly refers the reader to ascertain the character of oils or oily substances which may be used (*supra*, p. 64); we find that the use of petroleum was described in the very first description of the process which was written by the patentees (*supra*, p. 65); we find that the complete specifications of the British patent corresponding to the patent in suit in terms describes petroleum (petrol) as the equivalent of oleic acid (*supra*, p. 66); we find that the patentee, Sulman, in a subsequent U. S. patent, said that petroleum (petrol) was the equivalent of oleic acid in the process of the patent in suit (*supra*, p. 67); we find that the plaintiffs have never contended that prior-art patents describing the use of petroleums did not describe the use of a suitable oil or "oily substance" for the practice of the invention, if used in the critically minute quantities described in the patent in suit (*supra*, p. 68); we find that the plaintiffs in the Hyde case, by their expert, Dr. Chandler, affirmatively stated that petroleums are included within the term "oil or oily substance" in the specifications and claims of the patent in suit (*supra*, p. 69); we find that plaintiffs' engineers in the Hyde case, and again in this case, have stated that at many plants installed by Minerals Separation, or operated under license from them, use, or have used, in every-day mill operations petroleums, either alone or in mixtures, and in some cases in mixtures having the precise proportions of petroleum (75%) now used by defendant (*supra*, pp. 69, 70); and we find that non-licensees in this country, both when they were using oil in quantities of about 0.1% on the ore, as well as since they have enlarged the amount to over 1% on the ore, used petroleum in mixtures (*supra*, p. 72).

In view of all these facts, it is simply amazing to hear plaintiffs' counsel now assert that petroleum is not among the oils, or oily substances, referred to in the specifications and claims of the patent in suit, and to

hear them allege that the petroleum constituent of defendant's mixture is used merely as a cloak and a blind, and should be subtracted by the Court from the total amount of oil used in determining the amount of "oil or oily substance" actually used by the defendant in its flotation operations.

The Circulating Load and its Effect.

In the first spitzkasten (or the "rougher cells", as they are called) there is constantly being introduced (1) new ore, (2) the circulating load composed of water, *oil* and ore, called the "middlings", and (3) *new oil*. If no new oil were introduced at this point still it is obvious that some oil would be present. To determine, therefore, the percentage of oil actually present in the rougher cells, we must take account of the oil introduced with the middlings. Hence, if we wish to have in the rougher cells 1% of oil on the total ore present, and the middlings contain just 1% of oil on the ore contained therein, we must add just 1% of oil on the new ore which is added to the rougher cells, in order to have in the cells 1% on all the ore which is present in them (*i. e.,* the ore introduced with the middlings plus the new ore). For the same reason, if we still wish to have in the rougher cells 1% of oil on the total ore present, and the middlings contain 1.5% of oil on the ore, we must add just 0.5% of oil on an amount of new ore added equal in amount to the ore introduced with the middlings. If we should add more than 0.5%, an analysis of the contents of the rougher cells would show that there was present more than 1% of oil on the total ore in the cells.

This is a matter of simple arithmetic, and is fully explained by Conrads (Tr. Vol. III, p. 1591, *et seq.*). Not one of plaintiffs' witnesses has attempted to deny this simple and self-evident fact. Plaintiffs' brief seems to say that their witnesses have denied it; but in fact they

have not. They simply have said that in their practice of the process heretofore they have never taken the oil in the middlings into account. They do not deny, however, that they should be taken into account if one desires to know the exact percentage of oil on the ore employed in the process.* The fact is, when operating with a circulating load, plaintiffs' witnesses have actually been using in the process a little more oil than their records indicate; but since they were not concerned, as defendant now is, in keeping track of the exact percentage of oil used, and since the amount used all-told was microscopic, it was perfectly natural that they should not trouble themselves about it. Defendant now must trouble itself about exact percentages, because (1) the question of infringement turns on it, and (2) the amount of oil used now is so large that economy compels defendant not to use more than it has to.

Plaintiffs' counsel in their brief seem to allege that since many cells are working simultaneously in defendant's mill, some of them in parallel and others in series, all the cells, after the first or rougher cells, must be operating on a smaller percentage of oil on the ore than is contained in the rougher cells. If this is what counsel mean to allege, the allegation is not at all in accordance with the facts, as is clearly proved by the record. For simplicity we will confine our discussion to the record of

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* Thus Grieninger only says (Tr. Vol V, p. 2413, Q. 97) that he never considered nor took account of the oil in the circulating load as part of the oil supply; and (Q. 99) that he never looked upon it from the light or considered it from the standpoint of an oil-saving operation. Thus Chapman only says (Tr. Vol. V, p. 2460, Q. 45) that he has never taken it into account. Thus Wiggins only says (Tr. Vol. V, p. 2390, Qs. 20, 22 and 23) that he has never taken it into account in determining the consumption of oil in the process. Thus Rossberg only says (Tr. Vol. V, p. 2433, Qs. 103, 104) that he never returned the middlings for the purpose of saving oil.

Not one of these witnesses said, or could possibly say, that in determining the actual percentage of oil on the ore present in the rougher cells, the oil in the circulating load should not be taken into account.

the joint test on April 29. The record of that test (Defendant's Exhibit No. 227, Tr. Vol. VI, p. 2935), taken in connection with the testimony of the witnesses (Tr. Vol. IV, p. 2196 *et seq.*) shows the following facts: 1.77% of oil on the ore was present in the rougher cells. The concentrates from the rougher cells went through a series of cleaner cells. This concentrate contained more than 1% of oil (to-wit, an average of 2.74%); and when it was discharged as a finished product from the third and last cleaner cells, it contained a still larger percentage of oil (to-wit, 3.13%). The tailings from No. 1 cleaners contained more than 1% of oil (to-wit, 2.18%); and these were put into the circulating load and went back to the rougher cells. The tailings from No. 2 cleaners contained more than 1% of oil (to-wit, 2.24%); and these tailings were sent to waste. The tailings from No. 3 cleaners contained more than 1% (to-wit, 2.74%, and these were carried back as a circulating load to No. 2 cleaners. This completes the record of the cleaner operations, and gives a complete history of the concentrates discharged from the rougher cells. It will be seen that at all times the oil on the ore was more than 2%, and not less than 1%. The tailings from the rougher cells went to the middlings cells. From these cells the concentrates discharged contained more than 1% of oil (to-wit, 1.68%); and these were put into the circulating load and carried back to the rougher cells. The tailings from these middlings cells contained less than 1% of oil, but they were then and there shunted out of the system and discharged as waste.

The fact is, the process of the patent and the "critical proportions" of the patent have to do only with the percentage of oil on the ore in the rougher cells. The patent describes a one-cell process. Defendant's rougher cells correspond with the single cell of the patent, in which the prescribed amount of oil is to be used. After the ore has

been treated in that cell, the patent says that the tailings may be subjected to any desired supplemental treatment. Thus it says (p. 2, lines 25-39) that the tailings may be treated on a shaking table or the like, and it says (p. 2, lines 103-119) that they may be treated with compressed air. These treatments are, however, mere adjuncts to the main process, and have nothing to do with that process *per se*. They are not claimed in the patent in suit. Indeed, the supplemental cleaning of the tailings with compressed air is disclaimed, for the patent says (p. 2, line 116):

> "This idea is not claimed broadly in this case, but forms the subject-matter of an application filed by us on January 9, 1906, Serial No. 295,326."

In precisely the same sense defendant's treatment of the tailings in the middlings cells and Callow cells (when used) are mere adjuncts of the main process, and have nothing to do with that process *per se*. Indeed, the concentrates produced in the middlings cells and Callow cells (when used) are not taken off as a finished product, but are *returned to the circulating load and carried back to the rougher cells, to be there again subjected to treatment with something more than 1% of oil on the ore.*

THE THEORY THAT THERE IS SOMETHING PECULIAR ABOUT DEFENDANT'S ORE WHICH PERMITS THE USE OF MORE THAN 1% OF OIL IS NOT ESTABLISHED BY THE PROOFS AND WAS NOT ADOPTED BY THE COURTS BELOW.

Plaintiffs' witnesses intimate that there is something peculiar about defendant's ore—that it contains an undefined amount of an undefined material, which Greininger called "gangue slime" and which Chapman called "clay gangue"—which makes it possible for defendant to use above 1% of oil—the inference sought to be deduced from this being that but for the presence of the

so-called "gangue slime" it would be impossible to practice the process with more oil than given in the examples of the patent, *i. e.,* under one-half of 1%. This testimony is mere speculation and inference, and *being adduced in rebuttal* it could not be replied to directly. It has been, however, sufficiently replied to indirectly by the proofs in the record showing that oil in excess of 1% is being regularly used at other mills than that of the defendant, where there is no suggestion that the ore contains any "gangue slime" (whatever that may mean). The use of oil in excess of 1% on the ore has been, since the decision of the Supreme Court in the Hyde cases, regularly used at the Magna Mill of the Utah Copper Company, as testified to by Conrads (Tr. Vol. III, p. 1568, Q. 129, *et seq.*); at the Arthur plant of the same company, as testified to by T. A. Janney (Exhibit 30, Tr. Vol. VI, p. 2736; also Tr. Vol. III, p. 1512, Q. 34, *et seq.*); by the Chino Copper Company, as testified to by Wicks (Exhibit 26, Tr. Vol. VI, p. 2736; also Tr. Vol. III, p. 1452, *et seq.*), and by the Ray Consolidated Company as testified to by Engleman (Exhibit 44, Tr. Vol. VI, p. 2752; also Tr. Vol. III, p. 1609, *et seq.*). In each case the mill records of the plants, both before and after the use of oil above 1% on the ore was adopted as the regular mill practice, were produced.

So we see it is not anything peculiar about defendant's ore—the alleged presence of something nebulously called "clayey gangue," but not identified by any analysis, although complainants' experts had plenty of defendant's ore to analyze and by which to prove its constituents, if they had seen fit to do so—which enables the defendant to use more than 1% of oil on the ore, because it is proved that at other mills, where the ore is not the same, amounts of oil in excess of 1% are being commercially and continuously used.

As a matter of fact, complainants' witness Chapman admitted that even if there were no "clay gangue" in

defendant's ore, still, in his opinion, the same amount of oil now being used could be used, and the same results in recoveries would be obtained—an admission which disposes of the whole matter and shows that it is merely dust injected into the mental atmosphere of the case to obscure the plain facts. Chapman said (Tr., Vol. V., p. 2468):

> "x-Q. 109. Now, you have explained the operations at the Butte & Superior which you saw by reference to the clayey gangue slimes you referred to. Is it your opinion that it would not be possible to practice the process with as large an amount of oil if that clayey gangue slime were absent?
>
> "A. You could practice the process if you followed out the process of the Magna mill.
>
> "x-Q. 110. Well, suppose we simply eliminate the criticism you make of the Magna mill and carry it out just the way they did at the Butte & Superior mill. Do you think that it would be impossible without the presence of this clay gangue slime you refer to?
>
> "A. I should think it would be quite possible to carry out the process, yes.
>
> "x-Q. 111. With the same amount of oil?
>
> "A. Yes, with the same amount of oil.
>
> "x-Q. 112. And the same procedure?
>
> "A. Yes, the same procedure.
>
> "x-Q. 113. And in the absence of the clay gangue?
>
> "A. In the absence of the clay gangue, yes.
>
> "x-Q. 114. And it still would be the agitation froth process?
>
> "A. Absolutely."

Furthermore, the suggestion or contention that there is something in defendant's ore which "soaks up oil like a sponge" is conclusively contradicted by the statement made by Mr. Williams in his opening argument in the District Court, where he said (printed report Plaintiff's Oral Arguments, pp. 27, 28):

> "* * * we find that at the Timber Butte mill they have an ore which is *very nearly the same*

> *as the defendant's ore,* which is being treated with .7 of a pound of pine oil. * * * It comes pretty near to being the smallest amount that has been used."

If an ore which is "very nearly the same as defendant's ore" can be treated with "pretty near the smallest amount that has been used", it is evident that it does not have in it a constituent which "soaks up oil like a sponge".

This is confirmed by Defendant's Exhibit 158 (Tr., Vol. VI, opposite p. 2882), which contains a report of defendant's flotation operations. This exhibit shows that during the year 1915 the average pounds per ton of oil used by defendant was 1.49 pounds, being 0.07% on the ore, and that the recovery was 90.36%, while the tailings carried 1.73% of values. These results could not have been obtained if there had been in the ore something which "soaked the oil up like a sponge". Again, this exhibit gives the percentage of oil in the concentrates and in the tailings. If there was something in the ore which "soaks the oil up like a sponge" we would find most of the oil in the tailings, and comparatively little oil in the concentrates; whereas an examination of the exhibit will show that, when using more than 20 pounds of oil per ton of ore, the oil in the concentrates ran from 1.86 to 2.45%, while the oil in the tailings ran only from 0.55 to 0.71%. In the joint run at defendant's plant on April 29, 1917 (see Defendant's Exhibit 227, Tr., Vol. VI, p. 2935), the oil in the concentrates was 3.13%, and the oil in the tailings was only 0.35%. Nor is this a peculiarity of the results obtained when using above 1% of oil. for when only a small fraction of 1% of oil is used, the concentrates also carry most of the oil. This is shown in Prof. Chandler's table in the Hyde case (Tr., Vol. I, p. 187). That table shows that using a very small fraction of 1% of oil, the middlings and concentrates carried 87.2% of the total oil

used, and the tailings carried only 12.7% of the total oil used; and this notwithstanding the fact that the quantity of the tailing was considerably more than the quantity of the middlings and concentrates.

THE SUGGESTION THAT BY SOME TRICK OF OPERATION DEFENDANT DOES NOT USE IN THE PROCESS THE AMOUNT OF OIL WHICH IT APPEARS TO USE IS NOT WARRANTED BY THE RECORD AND WAS IGNORED BY THE COURTS BELOW.

Chapman, a technical witness for plaintiffs, in referring to the daily run at the Magna plant of the Utah Copper Company, which he saw on Saturday, April 22, 1917, insinuated that the first box was used as a de-oiling vessel. He did not say this positively and unqualifiedly, but in a manner that was evidently intended to reflect on the honesty of the Magna operation and on its staff. He said (Tr. Vol. V, p. 2455):

> "Now, the overflow from the first box on the side of the machine that we were examining was very intermittent; I judge that it overflowed perhaps ten minutes in every hour. This intermittent overflow interested me so much that I made several visits to the *other side of the machine,* and I noticed that of the five visits that I made it was overflowing on four occasions; and *indeed it would be quite easy, and it would be a great temptation to remove that oily float continuously in ordinary operations.*"

He does not boldly say such was the case, but that "*it would be easy*", and that "*it would be a great temptation*". Such testimony is not the kind to which courts of equity pay any serious attention. Strange it is, this being an *inter partes* affair, where every courtesy was extended to these witnesses of the plaintiffs' staff, that he did not call these alleged overflows to the attention of the observers who were present and representing the Magna plant.

The witness Greininger, a former member of plaintiffs' technical staff, was present as an observer for plaintiffs at the Magna plant on April 22d during that day's run, and said of the first spitzkasten (Tr., Vol. V, p. 2409) that—

> "The first spitzkasten produced concentrate intermittently; * * * the float in the first spitzkasten was very oily, largely an oil emulsion", etc.

He had, however, to acknowledge that (Tr., Vol. V, p. 2409, Q. 56):

> "At the time the sample was taken it was not overflowing."

This acknowledgment was due to the fact, undoubtedly, that during the taking of the samples an observer representing the plant was on hand.

Janney, the general superintendent of all of the Utah Copper Company's mills, was called in surrebuttal and testified that he was present at the mills of the Magna plant on April 22d during the visit of the witnesses Chapman and Greninger. He said in regard to the operation of the first cell (Tr., Vol. V, p. 2651, Q. 16):

> "The first cell was operating as an emulsifier * * * for some time * * * since the middle of January. No concentrate was produced in that cell. * * * It is not the intention in our operations to produce a concentrate on that cell, and although a concentrate is formed of mineral-bearing froth, *it is not discharged.* Occasionally the froth fills up to such an extent that it discharges of its own accord, but not with our intentional operations."

Of the froth produced in the first cell under consideration, he says (Tr., Vol. V, p. 2652, Q. 24):

> "It is a very light aerated froth, and the fact that it lies dormant on the surface of the water, and any air that is released in the spitzkasten has to rise through that froth, the result is that we get a very light, large bubble aerated froth."

THE ALLEGED PRESENCE OF SOLID GREASE IN THE FEED AT THE TEST ON APRIL 29TH.

It is stated in plaintiffs' brief that particles of solid grease were present in the feed during the test of April 29th, and that these were due to the fact that the temperature of the water was from 10° to 12° Centigrade. It is also stated that Sadtler's experiments with defendant's oil mixture, showing that solid particles of grease could not have been present in it, were conducted with water at 18° Centigrade, and therefore proved nothing. The facts are these: In the first place, it does not appear that anybody took the temperature of the water with a thermometer during the test. All that Chapman says is that the temperature (Tr., Vol. V, p. 2460. Q. 43) "I *should judge* to have been on that day between ten and twelve degrees Centigrade." Evidently this was mere guess-work. In the second place, Sadtler does not say that his experiments were conducted with *water* at 18° Centigrade. What he says concerning defendant's mixture of oil which he duplicated (Tr., Vol. V, p. 2645, Q. 16) is "I made that mixture entirely in the cold, simply by stirring the ingredients together entirely in the cold, and the *temperature of the mixture* as taken by a thermometer at the time was 18° Centigrade, which is relatively low, and *I believe* was under the temperature existing in the flotation mixture at the time of the visit on Sunday." In other words, he says the temperature of the *mixture of oils* when made was 18° Centigrade, and he *believed* that the temperature of the load during the test was above 18° Centigrade, and not between 10° and 12° Centigrade, as Chapman guessed. Both Chapman and Sadtler were guessing, and the guess of one is as good as the guess of the other. However, Sadtler gave 18° Centigrade as the temperature of the *mixture of oils* when made, and not the temperature of the *water* into which later he put the mixture. As to the temperature of the

water into which he put the mixture, he said (Tr., Vol. V, p. 2645, Q. 16), "Then a small amount of that liquid was put into a bottle containing *cold* water and was shaken up energentically." He was not cross-examined as to the temperature of the water, and there is nothing in the record to show that he measured it with a thermometer.

Any argument based on the precise temperature of the feed at the joint test (which nobody thought worth while to determine with a thermometer) is evidently a mere catching at straws, because nobody will contend that the process in its essentials would be changed by such minute difference of temperature.

PLAINTIFFS HAVE NO RIGHT TO MAINTAIN THIS SUIT BECAUSE THEY HAVE "UNREASONABLY NEGLECTED OR DELAYED TO ENTER A DISCLAIMER".

Our contentions with respect to the so-called disclaimer are:

(*a*) The intended effect of the disclaimer filed was to broaden the small-quantity claims (9, 10 and 11) and it is not, therefore, a disclaimer in law or in fact.

(*b*) Since plaintiffs' right to maintain this suit is derived solely from the remedial and enabling disclaimer sections of the statutes, which require the filing of a disclaimer *without unreasonable delay,* the plaintiffs, not having as yet filed a disclaimer in law or in fact, now have no right to maintain this suit.

The so-called disclaimer filed in the Patent Office by the plaintiffs, in its material part, reads as follows (Tr. Vol. I, p. cxxxiii):

> "Your petitioner * * * does hereby disclaim from claims 9, 10, and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the *results obtained*

are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

(*a*)

What was the intended effect of the so-called disclaimer?

To ascertain its *intended* effect we must go to the statements made by plaintiffs' counsel.

Plaintiffs' counsel stated in their oral arguments and in their brief in the District Court, that the purpose of the disclaimer was, in effect, to erase from claims 9, 10 and 11 all limitations as to the quantity of oil used, provided only the desired result was obtained.

In other words, whereas the patentees should have filed a disclaimer erasing the invalid claims, or limiting them, as the valid claims were limited, to the use of a fraction of 1% of oil on the ore (in which case the invalid claims as limited by the disclaimer would not differ materially from the valid claims), what they actually attempted to do was to broaden claims 9, 10 and 11 to cover the use of any quantity of oil, however large, which would accomplish the desired result.

Thus, in the oral argument before the District Court, Mr. Kenyon said, in answer to a question by the Court (p. 61 *):

> "THE COURT: The patent here in suit has been rather narrowly construed?
>
> "MR. KENYON: On the contrary I think the Supreme Court has construed this patent *broadly* as for the process if and whenever the *results obtained are those that are obtained* when you effectively used this small quantity of oil."

Further he said (p. 64):

> "In one sense this is a construction of the patent, a holding that the patent cannot be extended

* The pages referred to here and following are those of the printed book entitled "Plaintiffs' Oral Arguments."

beyond that line. That is to say, the patent cannot be extended, under the Supreme Court holding, to the case of a process that *does not obtain the results there specified;* but it is, by the same token, a holding that the patent should be *extended up to that point.* It is equivalent to laying down a rule for determining any question of infringement of this patent (assuming oil and aeration, agitation and pulp), that the *results obtained* shall be the guiding test of infringement."

Further, he said (p. 82):

"First, as to the Supreme Court decision, for that is the most important thing in this whole litigation, and the meaning of that decision, for it is compelling upon this Court, whatever it may mean. Your Honor asked me if it was not a narrowing decision in a sense. In a sense it is a narrowing decision, and that feature of it, I think, strikes one on the first reading—on the first two or three readings—perhaps more prominently than anything else. But, studying and analyzing it, I believe it is essentially a *broadening* decision, and an *unusual and extraordinarily broadening* decision, and from that point of view I want to ask your Honor to study it a little with me."

Further he said (p. 93):

"The Supreme Court has limited the patent to an air-lift and an air-froth, and to the *sort of* an air-lift and air-froth that is produced when a fraction of one per cent. of active oil is added in the way and with the agitation specified. It has read 'air-froth' into every claim, instead of 'froth,' by cutting out oil-froth, and it has read into every claim the lifting by air as contrasted with the lifting by oil; and the disclaimer so limits claims 9, 10 and 11, and it is as if, for example, claim 9 read: 'The process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to

> form a froth, and separating the froth, when the *results obtained are substantially those that are obtained by the same procedure* when the oil effectively used is a fraction of one per cent. on the ore.' THAT IS THE LEGAL EFFECT OF THAT DISCLAIMER."

Plaintiffs' counsel in their brief before the District Court explained why they did not disclaim the invalid claims. They said (p. 55):

> "The Supreme Court did not, as courts often do, direct the filing of a disclaimer. The burden was cast upon parties and counsel of deciding all the momentous questions involved. Had the patentees wholly disclaimed claims 9, 10 and 11, an infringer might triumphantly assert that *all claim to any process employing one per cent. or more of oil had been abandoned by the affirmative act of the patentees and that therefore the patentees were forever estopped from asserting that a process substantially the same as theirs and producing the same result by the same mode of operation, but using one per cent. or more of oil, was within their patent.*"

After quoting that part of Mr. Kenyon's oral argument above quoted, in which he paraphrases claim 9, as modified by the disclaimer, they said (p. 58):

> "So far as claim 9 is concerned, no distinction need be made between effective oil and inert oil. The identification by the *new result* associated with the words 'a small quantity of oil' *obviates any oil-quantity measurement as to the amount of oil used.*"

What this means in plain English is, that any quantity of oil above 1% on the ore, no matter how large it may be, is now the "small quantity" of claims 9, 10 and 11, so long as it does the work—which is only another way of saying that the limitation to a "small quantity" of oil was intended to be, and if plaintiffs' counsel are

right, has been completely erased from claims 9, 10 and 11 by the disclaimer.

Plaintiffs' counsel in their brief before this Court in the present case, after saying that they think the District Court was in error in interpreting the opinion of this Court in the Hyde case where it condemned the small-quantity claims as being too broad, and where it limited the patent to the use of a critical quantity of oil, give their interpretation of the opinion of this Court (p. 44, main brief) as follows:

> "Petitioners do not so interpret the decision of this Court and respectfully present their interpretation, viz., that this Court, although having no evidence before it that the process could be worked with one per cent. or more of any oil, nevertheless, in confining the patent and thereby limiting its scope, did not confine it to *the use* of a fraction of one per cent. of oil, but to a *process identifiable* by its results, wherein *the 'results obtained'* were the new results first obtained by the process of the patent in suit." (Italics theirs.)

Later in their brief counsel say, concerning the disclaimer, that it confines the patent to (p. 95, main brief):

> "A process such as described and claimed wherein the results obtained are such process-identifying results as are obtained by the use of a suitable oil or equivalent oily liquid in proportions amounting to a fraction of one per cent. on the ore."

Counsel, therefore, in their brief in this case, admit that the effect of the disclaimer is to make these small-quantity claims cover any process which produces such an agitation-froth as may be produced by the use of the critical amount of oil, *no matter how large a quantity of oil is actually employed.* Such a disclaimer unquestionably broadens the claims, as admitted by Mr. Kenyon before the District Court in the passages from his brief and oral argument above quoted.

So we see that these claims, which this Court said were too broad because they included the use of any "small quantity" of oil, have not by the disclaimer been limited to the use of a smaller quantity of oil, but have been broadened (if plaintiffs have accomplished their purpose) so that they are not now limited at all as to the *quantity of oil used* but only to the *results obtained.*

The trick of the disclaimer consists in artfully repeating certain words taken from this Court's opinion in such a way as to give them an entirely different meaning. This Court said (242 U. S. 271):

> "The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions'."

This language seems to be perfectly clear and entirely free from ambiguity. It says plainly that the patentees are not entitled to monopolize the results obtained by the use of oil in larger quantities, which the plaintiffs had induced this court to believe were essentially *different* results.

The disclaimer, however, instead of saying that claims 9, 10 and 11 are limited to the *"results obtained by the use of"* the so-called critical proportions of oil, say they are limited to a process in which the *"results obtained are the results obtained by the use of"* the so-called critical proportions of oil. By repeating the words *"results obtained"* in this way, their purpose was to expand the claims to cover any process using oil in which the results obtained were *like those* obtained by using the critical proportions of oil. The trick is clever, but it is transparent. This Court said the claims must be limited to the "results obtained by the use of" the critical proportions. The disclaimer says they are limited to "results obtained" *which are like those obtained* "by the use of" the critical proportions.

Obviously, then, the effort of the disclaimer is to claim *results per se.* Leaving out of consideration the fact that this is a broadening, and not a narrowing of a patent by disclaimer (a thing which is not permissible), yet nothing is better settled than that a claim which covers *results per se,* irrespective of the means of obtaining them, is invalid as a matter of law.

In *LeRoy* v. *Tatham,* 14 How. 156, 176, this Court, speaking by Mr. Justice M'LEAN, said:

> "A patent is not good for an *effect,* or the *result* of a certain process, as that would prohibit all other persons from making the same thing by any means whatsoever. This, by creating monopolies, would discourage arts and manufactures, against the avowed policy of the patent laws."

In *O'Reilly* v. *Morse,* 15 How. 62, 112, this Court, speaking by Chief Justice TANEY, said, concerning the eighth claim of the Morse patent:

> "It is impossible to misunderstand the extent of this claim. He claims the exclusive right to every improvement where the motive power is the electric or galvanic current, and the *result* is the marking or printing intelligent characters, signs or letters at a distance. If this claim can be maintained, it matters not by what process or machinery the result is accomplished. * * * The Court is of the opinion that the claim is too broad, and not warranted by law."

Assuming, for the sake of argument, that this Court decision was a "broadening" decision (which, of course it was not), yet the only way in which advantage could be taken of it is by means of a *surrender* and *reissue* of the patent—that is, by a proceeding under Section 4916. The disclaimer sections are strictly limited to

cases in which (Sec. 4917) "the patentee has claimed *more* than that of which he was the original or first inventor or dicoverer," and (Sec. 4922) has "claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was *not* the original and first inventor or discoverer," and the only act on the part of the patentee justified by these sections is that he may (Sec. 4917) "make disclaimer of such parts of the thing patented as he shall *not choose to claim or to hold by virtue of the patent.*"* A disclaimer which seeks to broaden a patent is, therefore, without warrant of law, and is a nullity.

* Nothing is better settled than that there is no warrant in law for *broadening* a patent by disclaimer, and no warrant in law for converting by disclaimer a claim for one thing into a claim for a *different* thing.

In *Union Metallic Cartridge Co.* vs. *U. S. Cartridge Co.*, 112 U. S. 624, the Supreme Court, speaking by Mr. Justice BLATCHFORD, said (642):

> "A disclaimer can be made only when something has been claimed of which the patentee was not the original or first inventor, and when it is intended to limit a claim in respect to the thing so not originally or first invented. It is true that, in so disclaiming or limiting a claim, descriptive matter on which the disclaimed claim is based, may, as incidental, be erased, in aid of, or as ancillary to, the disclaimer. But the Statute expressly limits a disclaimer to a rejection of something before claimed as new, or as invented, when it was not new or invented, and which the patentee or his assignee no longer chooses to claim or hold."

In *Carnegie Steel Co.* vs. *Cambria Iron Co.*, 185 U. S. 403, the Supreme Court, in approving a disclaimer, speaking by Mr. Justice BROWN, said (436):

> "Had the purpose of the disclaimer been to reform or alter the description of the invention, or convert the claim from one thing into something else, it might have been objectionable, as patents can only be amended for mistakes of this kind by a reissue."

In *White* vs. *Gleason Mfg. Co.*, 17 Fed. 159, Judge WHEELER, condemning a disclaimer, said:

> "The disclaimer could add nothing to the patent. It could take away from what was described as the invention and claimed as such, so as to be covered by the grant of the patent,

(*b*)

At common law a patent which was bad in part was bad in whole; a patent containing one invalid claim was wholly void (*Silsby* vs. *Foote,* 20 How. 378, 380; *Walker on Patents,* Sec. 203). Indeed, such is the rule in England to-day (*Frost Patent Law and Practice,* Vol. I, p. 251).

Speaking of Sections 4917 and 4922, the Supreme Court in *Hailes* vs. *Albany Stove Company,* 123 U. S. 582, speaking by Mr. Justice BRADLEY, said (p. 589):

> "They are parts of one law, having one general purpose, and that purpose is to obviate the inconvenience and hardship of the common law, which made a patent *wholly void* if any part of the invention was wrongfully claimed by the patentee, and which made such a defect in a patent an *effectual bar* to a suit brought upon it."

At common law a patentee had the right, if his patent was defective, and the defect arose through inadvertence, accident or mistake, to *surrender* the grant and obtain an amended grant for the unexpired portion of its term. This common-law right was affirmed as early as 1832 by this Court in *Grant* vs. *Raymond,* 6 Pet. 218.

Shortly thereafter and in the same year (1832), Con-

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but it had no office to make the patent cover anything, however clearly shown in the patent, not so described and claimed as a part of the invention. * * * Such changes appertain to reissues and not to disclaimers."

See, also, *Hailes* vs. *Albany Stove Co.,* 123 U. S. 582, 587; *Albany Steam Trap Co.* vs. *Worthington,* 79 Fed. 966, 969; *Westinghouse Air Brake Co.* vs. *New York Air Brake Co.,* 139 Fed. 265; *Bracewell* vs. *Passaic Print Works,* 107 Fed. 467, 469.

It is, therefore, a perfectly well-settled principle of law that the only function of a disclaimer is to limit a patent. A disclaimer which attempts to broaden a patent, or which attempts to change a claim for one thing (as the use of a "small quantity" of oil in the production of a froth), into a claim for a different thing (as the production of a froth by the use of *any quantity* of oil), is a nullity.

gress enacted a statute to regulate the grant of reissued patents, which, without material change, appears now as Section 4916, R. S. (*Walker on Patents,* Sec. 211).

While the reissue statute permitted a patentee to *surrender* an invalid patent and obtain a reissue (*by which act he forfeited all rights to past damages and profits*), it did not change the common-law rule that a patent bad in part was bad in whole, and that an invalid patent could be amended only by surrender and reissue. In order to mitigate the hardship of that rule, the disclaimer statutes were enacted in 1837, which, without material change, appear to-day as Sections 4917 and 4922, R. S., which read as follows:

> "SEC. 4917. Whenever, through inadvertence, accident or mistake, and without any fraudulent or deceptive intention, a patentee has claimed *more* than that of which he was the original or first inventor or discoverer, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented; and any such patentee, his heirs or assigns, whether of the whole or any sectional interest therein, may, on payment of the fee required by law, make disclaimer of such parts of the thing patented as he shall *not choose to claim or to hold by virtue of the patent* or assignment, stating therein the extent of his interest in such patent. Such disclaimer shall be in writing, attested by one or more witneses, and recorded in the Patent Office; and it shall thereafter be considered as part of the original specification to the extent of the interest possessed by the complainant and by those claiming under him after the record thereof. But no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing it."
>
> "SEC. 4922. Whenever, through inadvertence, accident or mistake, and without any willful default, or intent to defraud or mislead the public, a patentee has, in his specification, claimed to be

> the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was *not* the original and first inventor or discoverer, every such patentee, his executors, administrators and assigns, whether of the whole or any sectional interest in the patent, may maintain a suit at law or in equity, for the infringement of any part thereof, which was *bona fide* his own, if it is a material and substantial part of the thing patented, and definitely distinguishable from the parts claimed without right, notwithstanding the specifications may embrace *more* than that of which the patentee was the first inventor or discoverer. But in every such case in which a judgment or decree shall be rendered for the plaintiff, no costs shall be recovered unless the proper disclaimer has been entered at the Patent Office before the commencement of the suit. *But no patentee shall be entitled to the benefits of this section if he has unreasonably neglected or delayed to enter a disclaimer.*"

In substance, Section 4917 provides that in case of an overclaim, a patentee, *without surrendering his patent* (and thereby extinguishing all claims for past infringements), may cure the defect by filing a disclaimer in the Patent Office; and Section 4922 provides that a patentee may maintain a suit on his patent while it contains an overclaim, providing, however, "*no patentee shall be entitled to the benefit of this section if he has unreasonably neglected or delayed to enter a disclaimer.*"

It follows, therefore, that if a patent contains an overclaim, and the patentee unreasonably neglects or delays to cure it by disclaimer, he loses all right of action under the patent.

The District Court of Delaware in the Miami case as early as September, 1916, decided that claim 9 (claims 10 and 11 not being in issue in that case) was broader than the patentee's actual invention. According to some authorities, it thereupon became incumbent on the plain-

tiffs to promptly file a disclaimer if they would preserve their right of action on the valid claims. The fallacy of this rule, however, was pointed out by the Circuit Court of Appeals for the Second Circuit in *Page* vs. *Dow-Jones*, 168 Fed. 703. As the Court there said, clearly a patentee has the right to wait until the Court of last resort has determined the existence of the overclaim, before he is called upon to file a disclaimer. In other words, it was not unreasonable for the plaintiffs to delay filing a disclaimer until the Court of last resort had finally determined the fact of the existence of an overclaim.*

In December, 1916, the Supreme Court handed down its decision in the Hyde case, and by that decision it was authoritatively and finally determined that the patent in suit contained an overclaim, in that claims 9, 10 and 11 were broader than the patentees' actual invention. After that decision was handed down, it was incumbent on the plaintiffs to file without unreasonable delay a disclaimer which would cut out this overclaim if they wished to maintain their right to sue on the valid claims of the patent (*O'Reilly* vs. *Morse*, 15 How. 62, 120; *Seymour* vs. *McCormick*, 19 How. 96; *Gage* vs. *Herring*, 107 U. S. 646).

While the plaintiffs did, thereafter, file a paper in the Patent Office which they called a "disclaimer", we have shown that that paper was not intended to cut out the condemned overclaim, and did not, in fact, cut out the condemned overclaim. We contend that, therefore, no disclaimer in contemplation of Sections 4917 and 4922 has been filed and, for this reason, that plaintiffs have no

* The question as to when the period of "unreasonable delay" begins to run was raised as early as 1857 in the case of *Silsby* vs. *Foote*, 20 Howard, 378. Justices GRIER and DANIEL in a dissenting opinion expressed the view that the period begins to run when a claim is declared invalid by a Circuit Court (p. 388); but by the prevailing opinion it was held that the period does not begin to run until the Supreme Court has passed upon the validity of the claim (p. 386). *That the period begins to run when the Supreme Court has declared a claim invalid has never been questioned, and, indeed, is not open to question.*

right to maintain this suit, because the patent still contains the condemned overclaim.

We have shown that the plaintiffs' rights to maintain this suit, if they have any such right, is derived from the provisions of Sec. 4922 R. S., and from no other source. We have shown that the "benefits" of that section extend only to those who have not "unreasonably neglected or delayed to enter a disclaimer". We have shown that the paper entered in the Patent Office and called a "disclaimer" is not a disclaimer in law or in fact; that plaintiffs' counsel who filed the disclaimer admit that its purpose was not to limit claims 9, 10 and 11 to the use of a fraction of 1% of oil, but was, by an artful repetition of the words *"results obtained"* used by this Court, an attempt to make these claims cover any process in which the desired results are obtained.

Such being the facts, no one will say that the plaintiffs have not "unreasonably neglected or delayed to enter a disclaimer". Not only have they failed honorably to conform with the conditions imposed by the statute as precedent to the enjoyment of the "benefits" of Sec. 4922; but they have done worse. They have attempted by shifty practices to expand their patent while pretending to limit it.

Deprived of the "benefits" of Sec. 4922, they have no right to maintain this suit.

Conclusion.

It is respectfully submitted that the decree should be affirmed with costs.

Thomas F. Sheridan,
J. Edgar Bull,
Frederick P. Fish,
Thomas L. Chadbourne,
Kurnal R. Babbitt,
J. Bruce Kremer.

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1918.

No. 599.

MINERAL SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited,
Respondent.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

REPLY BRIEF FOR PETITIONERS.

The brief for defendant-respondent contains a number of erroneous statements as to the facts shown by the Record, as well as wholly erroneous conclusions, which require correction.

FUNDAMENTAL MISCONCEPTION OF THE DECISION OF THIS COURT IN THE HYDE CASE.

Throughout the brief it is assumed, just as it was assumed by the Circuit Court of Appeals in the instant case, that this

Court in the Hyde case found that the process in suit was an old process, operating in an old and well known manner, utilizing old and well known functions, and producing an old technical result, and that the only novelty which this Court found in the process was a saving in the quantity of oil used.

For example, on page 45 the entire argument presented to show that,

> "defendant does not *obtain the results* which could be obtained by using the 'critical' quantities of oil to which this Court limited the valid claims of the patent in suit"

is a reference to the proof that defendant's operations since January 7, 1917, have involved a "decrease of profit on one year's treatment due to the use of this large amount of oil."

This decrease in profit, as we have shown (Brief for Petitioners, p. 25) is only about one eighth of the profit defendant would have made if it had not poured into its pulp the ineffective oils used by it. It retains seven eighths of the profit that petitioners' invention has brought to it.

Defendant then repeats in substance the statement that was made in its brief before the Circuit Court of Appeals, and which is quoted on pages 25 and 26 of Brief for Petitioners, as follows (Brief for Defendant-Respondent, p. 45):

> "It will be seen, therefore, that according to plaintiffs' own figures defendant has sacrificed *about a million dollars a year* in recoveries and added expenses in avoiding trespass upon the rights of the plaintiffs, as they have been defined by this Court; and that, therefore, the defendant not only does not use the 'critical proportions' of oil to which plaintiffs' patent is limited, but it is not obtaining *the results* which could be obtained by the use of such 'critical proportions.'
>
> "What we understand this Court sustained the patent for is the difference between the results produced by the use of less than 0.5% of oil and the results produced by the use of larger quantities of oil."

In other words, defendant's statement is that the only novel result attending the process in suit for which this Court sus-

tained the patent in suit was the financial advantage resulting from economy of oil in an old process.

Again, we find on page 57, following a second reference to the decreased profits of defendant's operations since January 7, 1917, these statements:

> "Of course, in one sense it is true that any excess oil above the smallest quantity which will do the work is 'wasted.' What this Court has held is, that the *soul of this invention* is the *avoidance* of that *'waste,'* with the superior metallurgical results and the less 'oily' froth incident thereto. Defendant has not avoided that 'waste' with its accompanying disadvantages of lower recoveries and a more 'oily' froth, and therefore it has not infringed."

Thus the *soul* of the invention is stated to be mere economy in the use of oil, with whatever advantages are incidental thereto, notwithstanding the fact that this Court said of the invention (242 U. S., 266).

> *"It differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery"*

and further (p. 269)

> *"that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical"*

and that this Court adopted the statement of a witness that the process of the patent in suit (p. 268)

> *"produces a result never obtained before,"*

and quoted with approval from the House of Lords, Lord Shaw

> " 'They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a method of

separation which had before been described, but they are engaged upon a *new method of separation.*'"

DEFENDANT DISCUSSES PRIOR-ART QUANTITIES OF OIL INSTEAD OF PRIOR-ART PROCESSES.

From the viewpoint of the argument of defendant, the whole prior art consisted of processes for producing mineral-air-froth with varying amounts of oil, by agitation and aeration, and so we find in defendant's brief what purports to be a presentation of this prior art as it was said to be before this Court in the Hyde case, which starts with the Elmore bulk-oil process (p. 7) and runs through the other processes disclosed in prior documents, concluding with a resumé on page 11. Throughout this discussion and resumé *the only thing considered is the amount of oil used.* That every one of these processes was wholly distinct and different from the process in suit, and that in no one of these processes was a mineral-air-froth produced by agitation, is entirely ignored as if immaterial. The assumption is that this Court found in its opinion that the only thing to be considered is the amount of oil that the respective prior inventors mentioned, or as defendant terms it, the *prior-art quantities of oil.* This resumé altogether neglects the facts as proved in the Hyde case and the admissions of defendant's patent expert Dr. Sadtler in the instant case as to these prior disclosures.

As to Elmore it is universally conceded that this process was pure oil-buoyancy flotation and nothing else. Dr. Sadtler so testifies (Vol. III, p. 1637, Q11).

As to Haynes, in which the ~~oil~~ is mixed with ~~water~~ to form a stiff paste, which is then kneaded with water to wash out the gangue, Dr. Sadtler admits that this process is one in which all of the ore particles are agglomerated by oil into masses, from which the gangue is separated by a washing out process, the oil-coated mineral particles sticking together (Vol. III, p. 1630, Q6), and says that he does not cite it "as prior art

strictly speaking" (p. 1661, Q129) (See Supplemental Brief for Petitioners, pp. 144, 145).

As to the Everson process referred to in the resumé, wherein 5% of oil on the ore is used, this is the first process of Everson, and like Haynes it is a process wherein the oil and ore are made into a pasty mass, from which the gangue is washed out. Dr. Sadtler repeatedly admits this, and the following quotation from his testimony includes this admission (Vol. III, p. 1630, Q6):

> "I would like to classify in a general way the processes which involve the use of oil in oil [ore] concentration. The first use of oil in this connection of oil [ore] concentration would be for the purpose of agglomerating the sulphide and other mineral particles into masses, from which the gangue can be separated by various washing out processses. Now, in this category will fall, of course, the Cattermole process of making granules and washing them out by up-cast. In this category would also fall the Haynes invention described in the Haynes patent, and the first process of Everson would also involve the agglomeration or bringing together of the sulphide particles with oil and the washing out process."

(See also Supplemental Brief for Petitioners, pp. 145-149.)

The Kirby process resembles Elmore in that the metal is carried in a floating layer of oil and is lifted upward chiefly by the buoyancy of oil. Here there is some assistance from air bubbles in lifting the mineral up in the pulp, but the air bubbles, when they reach the oil layer, must of necessity drop what, if any, mineral they carry, because, in oil, air bubbles have not the slightest adhesion to mineral particles. Here the capture and holding of the mineral particles in the oil layer, in so far as they are held there, is largely due to the increased viscosity of the interface between the oil layer and the upper surface of the water on which it rests. The scientific facts are quite fully considered in the present record (See Supplemental Brief for Petitioners, pp. 167-170).

The Froment patent and the Froment description were characterized by this Court (242 U. S., 266) as

"little more than a laboratory experiment."

The float obtained is described by Froment as a magma (Vol. III, p. 1333, line 39). This is a paste of oil and metalliferous mineral inflated by gas bubbles. The metallic particles are not attached to these gas bubbles. They are merely entrapped in the mass of oil, as in Elmore and Kirby. The bubbles diminish the specific gravity of the mass just as pores do in a cork (See Supplemental Brief for Petitioners, pp. 153-156, as to the Froment patent and Froment description, and pp. 176, 177, as to magma). Further the Froment description is merely an abandoned experiment, earnestly experimented with and deliberately abandoned a year and a half before the invention in suit was made. It constituted no part of the prior art open to the public, for it was a secret document of petitioners' laboratory, and if it taught the patentees anything it taught them the futility of attempting to concentrate ore by quantities of oil so small as one per cent. It does not describe the defendant's process or the patentees' process, but something entirely different. And the patentees turned from it to Cattermole.

Defendant's resumé also includes Cattermole, the typical metal-sinking process of the art, and the only one of this class that reached the mill, where it failed and was superseded by the process in suit. Obviously it has no relevancy to flotation processes of any kind; it is antipodal to flotation processes. It is cited as a disclosure of the use of oil—of a prior-art quantity of oil. The reference to it, aside from its utter irrelevancy, contains a serious miscalculation. On page 10 a reference is made to the testimony in the instant case as to the *present* zinc content and metalliferous mineral content of the defendant's ore, 15% zinc and 22% metalliferous mineral, and it is said that this Court had before it in the Hyde case examples of that ore which contained this zinc and metalliferous mineral content. By the arithmetical

method of determining what percentage of oil should be used in carrying out the Cattermole process with defendant's ore (which method ignores the seven variants which enter into the determination, making arithmetical determination impossible), defendant computes that only 0.88% of oil would be necessary to carry on the Cattermole process with defendant's ore, and repeatedly (once on page 10, three times on page 11, twice on page 13) says that this Court had that figure in mind in the Hyde case. *This must be an error of fact.* When the Hyde testimony was taken defendant's ore was of very much higher grade, and all the examples given in the Hyde Record (Vol. I, p. 183, Q10; p. 188, Expt. 2; 189, Expt. 5; Vol. 11, p. 865, Q45; p. 923) contained about 21% of zinc, which would be about 32% of metalliferous mineral, and this, by defendant's method of calculation at 4% of the metalliferous mineral, would change the amount of oil to 1.28% on the ore instead of 0.88%. At 6% on the metalliferous mineral this would be 1.92% on the ore, and at 10% on the metalliferous mineral this would be 3.2% on the ore. These are the particular percentages mentioned by Cattermole. But the only test is that of carrying on the Cattermole process (See Supplemental Brief for Petitioners, pp. 156-165). The testimony of Professor Chandler in the Hyde case referred to by defendant is first that the "recommended percentage" of the Cattermole patent for Broken Hill tailings containing about 30% metalliferous mineral "would be 1.2 to 1.8 per cent. on the tailings, which in this instance would be the ore" (Vol. I, p. 529). This is a mere arithmetical deduction not put forward as a statement of the amount of oil necessary for the Cattermole process. The second reference (Vol. I, p. 541, Q125) is to Professor Chandler's statement as to what had been used in carrying out the Cattermole process, and here Professor Chandler says that in that process "there was agitation of an ore pulp with an amount of oil as small as 1½% of the ore, or 30 lbs. to the short ton." This is the smallest quantity of oil that has ever been used in the Cattermole process. It was the result of laboratory refinements never realized in the mill. It was the oil proportion

that was being used in petitioners' laboratory for the Cattermole process at the time of the birth of the invention in suit, and it was from this proportion that a reduction of oleic acid to one half of one per cent. gave the indicia of the presence of the process in suit and a reduction to one tenth of one per cent. disclosed the process in suit to its best advantage.

But the Cattermole proportions for Broken Hill ore and oleic acid are not necessarily the Cattermole proportions for every ore and every oily liquid, just as the mineral-froth-forming proportions for Broken Hill ore and oleic acid are not the mineral-froth-forming proportions for every ore and every oily liquid.

If it should be found that a particular oil with a particular ore produced the Cattermole granulating operation and metal-sinking result when less than one half of one per cent. of the oil was used, the process would still be the Cattermole metal-sinking process and not the process of the patent in suit.

At page 18 of defendant's brief it is stated that in the Hyde case several of petitioners' witnesses examined on the point

> "testified that quantitites of oil above 0.5% (the maximum amount specified in the patent) were not capable of producing the desired results."

The citations do not support the statement.

The fact is that petitioners' witnesses were testifying about bubble-modifying oils, especially oleic acid, and most of them were testifying as to practical operations in the mill. It appeared to be the fact in the Hyde case, and it appears to be the fact in the instant case, that with bubble-modifying oils no practical process of ore concentration has ever been carried on in the mill with a greater amount of oil than one half of one per cent. on the ore. Indeed in the instant case defendant in its use of oleic acid attained its maximum in the second quarter of 1913 with an average of 9.82 pounds to the ton of ore (0.49% on the ore), an unusually large amount of this

oily liquid for mill operations, and the greatest amount of it that has ever been used in any successful mill operations (Defendant's Exhibit No. 158, Vol. VI, original paging 5185, facing p. 2882). The table shows that the defendant was at that time using too little sulphuric acid, to wit, 3.41 pounds per ton, as contrasted with the average of its best operations of something more than five pounds per ton, and was obtaining a low grade concentrate, 46.09% zinc and a low recovery 85.71%. This is the greatest amount of bubble-modifying oil that defendant has ever used in any operations either before or after January 7, 1917, and it tends to confirm the testimony in the Hyde case in this particular.

On pages 21-27 defendant's brief presents its argument as to the *California Journal of Technology* (a publication not in the Hyde case but which was not referred to by the defendant in argument or brief before the Circuit Court of Appeals). This publication is discussed by us in Supplemental Brief for Petitioners, pages 170-179. Defendant says (p. 21).

> "It is not contended that this publication contains an anticipation of the patent in suit as it has been construed by this Court"

and further says (p. 22).

> "It [the publication] emphasizes the fact, therefore, that agitation froth concentration is not new with the patentees of the patent in suit. It emphasizes the fact that the only novel thing contributed to the art by these patentees is the extremely minute quantity of oil which may be used in such a process"

In other words, defendant assumes that this Court has held the process of the patent in suit to be an old process which is disclosed in the California Journal of Technology as it was in the Hyde case in other patents and documents of the prior art, and that the patent has contributed only one novel thing

to the art, namely, an extreme economy of oil in this old process, and states that the California Journal of Technology merely emphasizes that situation.

The California Journal of Technology, aside from the fact that it is only an abandoned laboratory experiment, discloses a laboratory procedure which produced a magma and not a mineral froth and obtained results that would lead one away from, rather than toward, the invention in suit. It confirms the conclusions of this Court as to the prior art, and classifies itself in the "Surface Flotation Process" class specified by this Court, wherein reliance is had chiefly upon the buoyancy of oil for lifting the metallic particles and wherein the result obtained is essentially an oil float carrying the mineral. The authors say in description summary (Vol. VI, p. 2764):

> "The *oil* in this condition assumes a certain load of mineral and holds it in a very stable condition."

By way of illustration of the argument as to this publication defendant's brief states, at page 27, near the middle of the page

> "Thus Wicks testified to *mill* operations using 'crude oil' and 'Jones oil' (both petroleum)," etc.,

but the evidence cited shows that the operations referred to were not in the mill but in the laboratory, so that the statement should read

> "Thus Wicks testified to *laboratory* operations using 'crude oil' and 'Jones oil'" etc.

On pages 27 to 31 there is a reference to the testimony of Herbert C. Hoover, but it is not stated there that this testimony was given in the Hyde case, and therefore has already been considered by this Court.

In the Hyde case Mr. Hoover's testimony appears on pages 171-174 of the Transcript of Record there, partly abbreviated

to narrative form. In the instant case it appears *in extenso* at Volume II, pages 1043-1051. In cross-examination Mr. Hoover stated that his interest had always been on the commercial side and he disclaimed technical knowledge of the matters of which he testified (p. 1047, XQ28) and was unable to give any such description as made it possible to understand what processes he was really talking about.

In the above discussion in defendant's brief on page 28 reference is made to the *Potter* process. The Potter patents were in evidence in the Hyde case, but were not thought by defendant worth referring to in its brief in that case, as appears in the decision of this Court (242 U. S., 263), and they are not referred to in the evidence in the instant case. The statement appearing in defendant's brief that (p. 28).

> "In this [Potter] process, no oil is used, because sulphuric acid is itself a frothing agent and when sufficient quantities are used no oil is necessary."

is without foundation in this record or in the Hyde record and must have been made under a misapprehension as to the accepted scientific fact that sulphuric acid is not and cannot be a frothing agent.

Asserted Inconsistency in Petitioners' Arguments.

On page 31 of defendant's brief the thought is presented that the decision of this Court adjudging validity of the patent in suit in the Hyde case was largely based on two facts alleged to have been urged in argument by petitioners as established by the proofs in the Hyde case, and these are stated as follows:

> "(a) That while it is possible in the laboratory with *prior-art quantities* of oil and agitation to obtain highly useful metallurgical results, yet such results cannot be duplicated in mill operations.
>
> "(b) That there is a 'divide' which separates the territory of the prior-art from the territory of the patented process and that 'divide' is determined by the quantity of oil used, to wit, not above 0.5% on the ore."

And it is asserted that both of these alleged facts "are abundantly proved to be fictions by the evidence in this case."

Neither of these propositions is a correct statement of what was argued by petitioners in the Hyde case, and what was in fact argued there has not been proved to be fiction in the instant case but has been confirmed.

In the Hyde case it was first of all contended in behalf of petitioners that the prior art failed to disclose the process in suit or any anticipation thereof, and as to this we can only refer to our brief and arguments on file and to the decision of this Court describing and contrasting the prior art and the process in suit.

In the Hyde case defendant testified to having carried on certain laboratory experiments alleged to represent prior art processes. As to these experiments petitioners contended there that *they did not represent the prior art* and further that they were *the mere legerdemain of the laboratory* and were *not usable in the mill at all,* and that this was proved in the evidence in the Hyde case. It was proved there, and that proof is here, that 72 pounds of cottonseed oil and 72 pounds of oleic acid and 36 pounds of cottonseed oil per ton of ore all failed in the mill. (*Chapman* Vol. I, p. 553-557, Q247-250; *Higgins,* p. 551-552, Q31). *These oils are bubble-modifying oils.* They achieve the process of the patent at one-tenth of one per cent. on the ore. *That testimony of mill failure with such quantities of bubble-modifying oil stands uncontradicted in the instant case.* Defendant has not produced any evidence whatsoever of any use in the mill of these or of any bubble-modifying oils at one per cent. or more on the ore. The testimony cited on pages 38-41 as establishing the converse of our proposition is in every instance where the oils used aggregate one per cent. or more, testimony respecting procedures where a *mixture* of oils was used the bulk of which was constituted by alien oils that did not effectuate the process. The mixture involved three factors, viz.:

(1) a bubble-modifying oil,
(2) a soluble frothing agent, and
(3) a fuel oil or the like, which is not a bubble-modifying oil.

and in every instance the first factor was present in minute amount and it was only the third factor that was present in relatively large amount.

For example, in the case of the Chino Copper Company, referred to on page 40, the mixture first used at a total of a fraction of one per cent. was materially changed in the matter of proportions to enable it to be subsequently used at a total of one per cent. or more. It was not "the same mixture," as defendant's brief erroneously states. For, before the change the mixture consisted of 90% Barrett oil and 10% Jones oil (equivalent to fuel oil), and after the change the mixture consisted of 10% Barrett oil and 90% Jones oil. The Barrett oil was alone the factor that furnished the bubble-modifying oil and the soluble frothing agent, and the change was effected without substantially changing the quantity of that factor and simply by greatly increasing the quantity of Jones oil.

Similarly in the case of the Ray Consolidated Copper Company (pp. 40, 41) a similar change was made, that Company using after the change not "the same mixture," as defendant's brief erroneously states, but a very different mixture. Before the change about three pounds of Barrett oil was used and one pound of fuel oil, a total of four pounds per ton of ore, and after the change two pounds of Barrett oil was used and 18 pounds of fuel oil. The Barrett oil as before alone furnished the bubble-modifying oil and the soluble frothing agent, and the fuel oil, as before, did nothing to effectuate the process.

The abbreviated and confused mill experiments of Thomas A. Janney, which defendant refers to under this point at page 38, proved nothing at all, as the witness himself admitted (Supplemental Brief for Petitioners, pp. 136, 137) and are of no evidential value.

The other instances were similar, except that defendant before the change used pine oil alone, and altered its procedure

by adding thereto oils that did not effectuate the process, at the same time very slightly increasing the quantity of pine oil.

Defendant's brief concludes (p. 41) as to these mill operations

> "They completely refute the statements made by plaintiffs' counsel to this Court in the Hyde case, above quoted, that while such process could be practiced in the laboratory using more than 0.5% of oil, it could not be practiced in the mill. These proofs relegate to the realm of fiction alleged facts which, we think, largely induced this Court in the Hyde case to find valid the fraction-of-one per cent. claims of the patent in suit."

So far from refuting the statements made by plaintiffs' counsel to this Court in the Hyde case, and so far from relegating to the realm of fiction the facts found by this Court in the Hyde case, they confirm both.

The so-called large oil operations of the Utah Copper Company at its Arthur and Magna Plants, of the Chino Copper Company, of the Ray Consolidated Copper Company, as well as defendant's operations here in issue, demonstrate that in all of these instances a bubble-modifying oil had to be used and had to be used in critical proportions which were relatively minute to achieve the process of the patent in suit. The only additional fact demonstrated by these mill operations in the instant case is that certain oils that are not bubble-modifying oils and that cannot and do not effecuate the process, can nevertheless be used in admixture with a bubble-modifying oil and a soluble frothing agent and in an amount approximating one per cent. without defeating the process.

The very serious charge made in defendant's brief and repeatedly. that plaintiff's counsel argued one thing to this Court in the Hyde case and are arguing another thing to sustain the contention of infringement in this case, is not supported by the evidence or by the facts. The charge ignores the distinction between the use of a large quantity of bubble-modifying oils that effectuate the process and the use of a mixture containing a minute amount of a bubble-modifying oil and a soluble frothing agent, and in addition a large quantity of an oil that

is not a bubble-modifying oil and cannot effectuate the process. There was no discussion of the behavior of such mixtures in the argument of the Hyde case or of their relation to the invention or to the patent. There is no instance of the use of a bubble-modifying oil in quantity above one per cent. on the ore in the instant case. The behavior of such mixtures as are referred to above and their relation to the invention of the patent in suit is a new subject arising here for the first time.

Pages 42 and 43 of defendant's brief contrast the argument made by petitioners in the Hyde case in the matter of a "divide" with the argument made here on the issue of infringement, and imply inconsistency.

But in both statements as to petitioners' arguments, its argument then and its argument now, defendant's brief is in error and its implication of inconsistency is also error.

Petitioners' argument then was on the issue of invention, and it called attention to the complete transformation and alteration in results and character of results in passing from the Cattermole metal-sinking process to the process in suit by reduction of the quantity of oil used, as evidencing the existence of a "divide" in oil quantity above which was Cattermole and below which was the process in suit. In the particular instance cited involving the use of oleic acid with Broken Hill ore, the transformation in results indicated that that divide in oil quantity was at or above one-half of one per cent. on the ore. There was no argument made that this divide would be the same for all ores and all oils, or that it would be other than variable under different circumstances and conditions.

The argument of invention was enforced by the further contention that, as evidenced by the transformation in results, and the character of the new results, the inventors had really discovered and utilized a new characteristic and power and function of oil which appeared when the oil was used in minute and microscopic quantity (i e. below the divide) and was defeated when the quantity was increased above the

divide. And the evidence of the latter fact produced in the same argument was the failure in mill operations of 36 pounds and 72 pounds per ton of ore of oleic acid and cotton seed oil and the evidence of the beginning of deterioration in results which appeared in the mill when even small departures were made, either up or down, from proportions found to be *critical for the best efficiency* for the particular ore and conditions in that mill.

The contrasted statement of defendant's brief, page 43, that

> "here it is admitted that *prior-art quantities* of oil will do useful work and it is sought to make the patent cover such quantities"

does not correctly state what petitioners argue in the instant case.

Here the only issue presented is whether defendant's process with its peculiar mixture of oils infringes.

That process utilizes the oil-frothing characteristic and power and function of oil that the patentees discovered and invoked. There is no denial of this.

That process by that function of oil exorcises the power of air to lift the mineral particles. There is no denial of this.

That process obtains the mineral-carrying air-froth result that the patentees were the first ever to obtain. There is no denial of this.

And that process does all this because, and by reason of the fact that, it involves the use of an appropriate oil (pine oil) having that characteristic or power and in substantially the same minute quantity that the patentees recommended as best (three pounds to the ton of ore). There is really no denial of this.

Cooperating with this, but not defeating or excluding it, is the coincident action of a soluble frothing agent. There is no denial of this.

That process, as its only new factor, includes and involves the use and action of another and a different oil which lacks

the power to function as a mineral-frothing agent (viz: a mixture of fuel oil and kerosene, or equivalents) used in an amount such as to bring the total of both kinds of oil just above one per cent. There was contention at the trial and in the evidence as to the operation and effect of this relatively large quantity of fuel oil and kerosene in the process, and the District Court passed upon that question of fact and held that such oil lacked the characteristic or power of producing the mineral-froth required by the invention and was ineffective to that end in the process and was a mere diluent serving no useful purpose and somewhat diminishing the efficiency of the process. This finding of fact seems to have been reversed by the Circuit Court of Appeals, and whether that reversal was proper is one of the issues here.

But our argument here is that in any sense material to the invention and the patent and its claims the defendant is using the agent described in the patent and required by the process, viz: an oil having the characteristic or power in question and responding to the test prescribed by the patent and required by the invention and in the very quantity recommended in the example of the patent as the quantity best adapted for use and well within the limits specified in the narrowest claims.

We argue here that, in so far as concerns the use of an oil or oils, which, like defendant's fuel oil and kerosene, do not have the characteristic or power of bubble-modifying that lies at the basis of the invention, it is immaterial whether such oils are used or not, and it is immaterial in what quantity, large or small, they are used, so long as they are not used in such a way as to defeat the process of the patent, or in such a way or in such a quantity, as to exclude the process of the patent and substitute in its place some other and different process.

Defendant's brief repeatedly speaks of *"prior-art quantities of oil"* apart from the processes in which they were used and the characteristics of those processes, as if the mere arbitrary matter of quantity had alone to be considered. That would be so were this invention merely and only a saving in the use of oil in an old process, as the Circuit Court of Appeals held

in the Hyde case and continues to hold in the instant case. But quantity, apart from process and apart from the characteristics of process, is a matter of no moment here, because this Court in the Hyde case adopted a view of the invention *which differentiated it in kind* from anything that had gone before, holding it to be a process novel in its bubble-modifying function by oil, in its lifting by the buoyancy of air, and in its resulting mineral-carrying air-froth concentrate. In that view of the invention the mere listing of prior art quantities wholly apart from the processes involved, as defendant's brief lists and considers them on pages 7-13 is immaterial and irrational and only confuses the real issue. *What can be done now with prior art quantities of oil is also altogether immaterial to the issues here presented*, as it was in the Hyde case, *except when prior art processes are accurately reproduced;* and all that subject has been considered and passed upon.

Defendant's brief says on page 43:

> "In the present case the court hears nothing about the 'divide,' or about the 'critical' and 'microscopic' quantities of oil which alone do useful work."

The matter of the "divide" was material to the argument of invention. Here there is no argument of invention to be made. But just the same "divide" exists. In the Hyde case in our argument to show that invention was involved we pointed out that, in the case of oleic acid and Broken Hill ore, with which the inventors were experimenting, starting with Cattermole conditions and proportions of oil, in reducing the oil there came a region where the Cattermole process, operation and result gradually disappeared and the patentee's process, operation and result gradually appeared—this region constituting in a sense a "divide" over which the inventors had to pass on their way to the new country. This "divide" was not a sharply defined point, but rather a more or less broad neutral territory or "no man's land." In just the same way today with any other oil or oily substance capable of effectuating both the

Cattermole process (i. e. having agglutinating power) and the process in suit (i. e. having bubble-modifying power), with a given ore, starting with the proper conditions to achieve the Cattermole process and result, any one gradually reducing the oil in the same way would cross a "divide" in the same sense, and arrive at the operation and process in suit. This divide in the case of one particular ore with one particular oil would not necessarily be located just exactly where it would be with some other ore and oil, but, assuming the adaptability of the oil to each of the two processes, the rule of the patent would be universally true that it would require a considerable reduction from Cattermole proportions to pass over this divide and achieve the process in suit.

And so far as any evidence in the present case is concerned (and in this we include the defendant's operations and similar large oil operations of its allies, Utah Copper, Ray and Chino Companies), with any ores which have thus far been tested and with any oils that have the characteristic oil-modifying power required by the process in suit, the quantity of such oil that is required and apparently permitted (and is in that sense "critical" to bring about the results), is small and minute and microscopic in the sense of the description of the patent and of the arguments made by petitioners' counsel in the Hyde case.

Defendant's brief at pages 46-50 asserts and attempts to demonstrate that petitioners admitted in the Hyde case that a metal-bearing froth could be produced with one per cent. and more of oil, but contended it "was not *the* metal-bearing froth of the patent, being more oily and carrying less values."

The citations in this discussion utterly fail to sustain the point. It should be first noted, however, that what can be done today with one per cent. or more of oil is certainly not a prior art question, and is certainly not relevant to the issues here presented. The evidence referred to in defendant's brief established the negative of affirmative allegations there in behalf of defendant which misrepresented the prior art. Petitioners

contended first that the prior art had been misrepresented, and second that the experiments misrepresenting the prior art did not represent practical processes of ore concentration. The statements on page 46, wherein "a froth" and "the froth" are repeatedly quoted are wholly without foundation. The experiments by defendant's witnesses referred to on page 47 are experiments which misrepresented the prior art. They not only misrepresented the prior art, but they were mere freaks of the laboratory, and that fact was proved in the Hyde case. The evidence proving it is of the mill experiments heretofore referred to, wherein 72 pounds of oleic acid and cottonseed oil and 36 pounds of oleic acid per ton of ore were used. These operations were abject failures. They did not produce mineral-air-froths. The repeated use of the word "froth" in referring to the testimony of Messrs. Chapman and Higgins commencing on page 47 and continuing through page 48 is unjustified. In no single instance did these metallurgists describe the floats produced as "froths." Over and over again they called them "floats." This evidence appears in Vol. I, pages 551, 552, Higgins, Q31, and pages 554-557, Chapman, Qs249, 250. The fourth Chapman experiment is referred to in defendant's brief (p. 48) as giving "a froth recovery of 69.78% zinc, and 70.40% lead" and is characterized by defendant as giving "a very good result," and defendant's brief says, on page 46, that

> "Plaintiffs, indeed, admitted that recoveries substantially as high as those claimed for their process in the specification of the patent in suit could be obtained, and had been obtained by them, in a 50 ton testing plant, with the use of more than 1% of oleic acid, the specific oil mentioned in the patent in suit."

The operation so eulogized by the defendant was characterized by the witness Chapman himself as follows (Vol. I, p. 557):

> "I would say that these recoveries were in a concentrate of so low a grade that it would really not be con-

> sidered a concentrate. If you were to take a ton of ore and shift it from one bin to another, you would have 100% of your mineral in the second bin."

That is to say, this operation was not in any material degree an operation of concentrating ores, and the witness likened it to shoveling ore from one place to another.

The first object of the process is the concentration of the ore. The second object is not to lose too much mineral in concentrating the ore. If one loses 30% of the mineral without achieving concentration, he might better have done nothing at all.

The experiment by Mr. Higgins is described in defendant's brief as follows (p. 48):

> "So, Higgins reproduced in a 5-ton testing plant Dr. Byrnes' experiment, using 3.6% *straight cottonseed* oil (Tr. Vol. I, pp. 551, 522), and obtained a 'copious' froth which 'though oily in appearance *when closely examined*, did not differ in appearance from the usual agitation froth at a *distance of a few feet.*'"

And again, defendant's brief says that Higgins

> "admits that a 'copious' mineralized froth was produced"

And again that he

> "admits that froth concentration can be produced by using straight oils in quantities above 1% on the ore; and this fact was before this Court when it condemned as too broad claims 9, 10 and 11."

The testimony referred to is as follows (Vol. I, p. 552):

> "The float on the first spitzkasten was copious, being about one inch to an inch and a half deep, and though oily in appearance when closely examined, did not differ in appearance from the usual agitation froth *at a distance of a few feet.* These floats were exceedingly dense and occasionally fell down in large masses."

Thus it will be seen that the witness described the float, not as a froth, but as a dense oily float which occasionally fell down in large masses.

Mr. Higgins further testified that (p. 552):

> "The tailings contained some graules and did not indicate a satisfactory recovery"

and further that he obtained

> "a recovery of 50% of the zinc in the concentrates"

Thus the operation wasted one-half of the metal in the ore, an impossible operation in ore concentration.

Defendant's brief omits in describing this experiment to state the figures as to recovery, just as in describing the experiment of Mr. Chapman it omits to state the figures as to concentration.

Defendant's counsel appear to have wholly misconceived the force and meaning of the testimony.

In defendant's brief at pages 49 and 50 there are three quotations from Dr. Liebmann's testimony in the Hyde case cited to support the point which defendant is attempting to make. As to the first and second quotations it is only necessary to complete the second quotation to see that Dr. Liebmann's testimony leads to a directly opposite conclusion from that in support of which it is cited. At Vol. I, page 503, immediately following defendant's second quotation Dr. Liebmann said:

> "Dr. Byrnes says he has produced a froth with a large quantity of oil. If it is produced, it is not produced by the Froment process, but by the *process of the patent in suit.*"

As to the third quotation, from page 507, it is evident from the quotation itself that Dr. Liebmann is merely describing

concentrates, not froth concentrates. He testified to numerous Cattermole experiments wherein he sank granules and so obtained a concentrate and it was proved in the Hyde case that the Cattermole concentrate had been obtained with "quantities as small as 1.5%" on the ore.

It will therefore be seen that the evidence referred to by defendant under this point fails utterly to support the statements made therein and thereunder in defendant's brief. Indeed, the whole discussion is rather a discussion of words than of the substance of things.

Criticisms of Decision of District Court.

In criticizing the decision of the District Court defendant's brief (pp. 51-58) erroneously asserts that the District Court reverted to its former decision in the Hyde case. The errors of these criticisms are largely a repetition of the errors above pointed out. It seems surprising, however, that defendant's brief should assert that the presence in the operation of the process in suit of "an infinitude of bubbles" was a new theory first put forward in the opinion of the District Court in the instant case. It seems to us that the description of the process by Lord Shaw, quoted in the opinion of this Court, wherein Lord Shaw refers to "a multitude of air cells" (242 U. S., 269) in the pulp, and the other and frequent references in the decision of this Court to "air" and "air bubbles" and the statement in the opinion of this Court that the process consists "in so impregnating with air the mass of ore and water used" (242 U. S., 265), are sufficient authority for this quoted expression of Judge Bourquin. Further Judge Bourquin says (Vol. I, p. 94):

> "the patent fairly sets out the various ways and means to create this infinitude of bubbles and that they do the work."

Defendant's counsel appears to have overlooked the latter part of Judge Bourquin's statement just quoted in enlarging

upon the introduction of bubbles into pulps in the Cattermole metal-sinking and other processes (pp. 53-55), where they did no work. So far as relevant here this subject is considered in the Supplemental Brief for Petitioners (pp. 24-29), and generally in the discussion of the patent in suit (pp. 17-42), and Judge Bourquin's decision is quite fully discussed in Brief for Petitioners (pp. 32-52).

INFRINGEMENT.

Pages 50 and 51 of defendant's brief seem to admit by implication that defendant is in fact practicing plaintiff's process "badly," for it asserts that because of a special circumstance characterizing this case this does not constitute infringement. And the special circumstance is that

> "if the patent in suit covers practicing the process 'badly,' then it covers the prior art processes and is invalid."

The same idea is repeated at the bottom of page 51

> "To hold that defendant infringes when it uses more than 0.5% and even more than 1% of oil, would be to say that the defendant infringes when it uses prior-art quantities of oil. It would be equivalent to saying that by the issuance of the patent in suit the public has been deprived of the right to continue to do what it had done before these patentees entered the field."

But the special reason fails on the facts and therefore the general rule applies that a defendant cannot avoid infringement by practicing a patented process badly.

The special reason fails on the facts because the public had not done before the patentees entered the field what the defendant is doing now. The defendant is not now practicing any process of the prior art. The patent, if construed to cover defendant's procedure, will not be thereby made to cover any process of the prior art.

The defendant, in and by its use of pine oil, is using the patentee's process with the patentee's recommended quantity of oil, and at the same time, in so far as concerns the soluble constituents of that pine oil, it is practicing the process of the petitioners' later 1910 patent for the soluble frothing agent process. That pine oil is, like oleic acid, one of the oils that is adapted to effectuate the process and to respond to the test prescribed by the patent, is shown by defendant's procedure for two years or more prior to Jan. 7, 1917, when it used pine oil alone, and by defendant's admission that that procedure was an infringement and by the holding of both courts below to the same effect. The defendant in its additional use of 18 pounds more or less of fuel oil and kerosene per ton of ore since Jan. 7, 1917, is not using any process of the prior art. Those oils are appropriate oils in quality for the Cattermole metal sinking process, for they possess agglutinating power, but they are not used by the defendant in a quantity or in a way to bring about or effectuate that Cattermole process. Defendant does not recover any of its mineral by sinking. Everything that does not overflow as a froth runs to waste.

Further, the defendant in its additional use of 18 pounds of fuel oil and kerosene is not carrying on any of the processes classified by this court as the "Surface Flotation Process," for in each of them the process, as this court said

> "depends for its usefulness on the oil used being sufficient to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and by its buoyancy to carry them to the surface."

Fuel oil and kerosene are appropriate oils for such a process for they possess buoyant power in water, but the defendant does not use them in quantities sufficient to introduce that mode of operation or achieve that sort of result. Apparently almost half of this oil runs out with the tailings. 10 pounds out of every 26.37 pounds used so ran out in the tailings on the day petitioners witnessed the process. (See out Supplemental Brief p. 99.) The buoyant power of all the rest in water would

not account for the lifting of one half of one per cent. of the metalliferous matter that is in fact lifted in defendant's process. (Petitioners' Brief, p. 36, Note.)

Defendant's brief merely asserts that the defendant uses "prior-art quantities of oil"; *it does not name any process in the prior art which it is using.* The reason is clear, there is no such process which it could name.

The defendant's brief says at the bottom of page 50

> "Plaintiff's told this Court in the Hyde case that if one practised the process 'badly' it was not *their* process."

As we have shown the brief writer was laboring under a total misapprehension in this matter. The statement is immediately followed by another reference to the descriptions of the mill tests made by Messrs. Chapman and Higgins, which have been entirely misunderstood by defendant's counsel, as we have pointed out above.

Defendant's brief attempts to show why defendant and others who use the process in suit and have managed to increase the total amount of all oils used, both bubble-modifying oils and oils that do not effectuate the process in suit, to 1% or slightly more, have not gone much beyond that amount. The calculation is made at the bottom of page 44 and top of page 45. In this calculation the present cost of the oil mixture used at defendant's plant is applied to the figures of oil consumption at the Utah Copper Company's plant. The error of this method of calculation is obvious. The Utah Copper Company's ore is a lean copper ore and the oil mixture used is a different oil mixture from that which defendant uses. Defendant's brief states that the present cost of defendant's oil mixture is 12¢ per gallon. This figure is avowedly not taken from the record but may be accepted. The oil mixture at the Utah Copper Company's plant costs about one-half as much. This also does not appear in the record, but it clearly appears that the mixtures are wholly different. The expensive pine oil which defendant is compelled to use in its present opera-

tions at about three pounds to the ton with defendant's comparatively rich zinc ore is used to a much smaller extent with the Utah lean copper ore.

The record shows that in defendant's operations from January 9, 1917 to the end of March, 1917, the feed of ore to the flotation plant averaged 1521 tons per day (Defendant's Exhibits 159, 161, and 162, Vol. VI, following p. 2882). 1% of oil at 12¢ per gallon (7½ pounds per gallon at specific gravity 0.9) amounts to $486.00 per day for 1521 tons. The cost of each 0.1% increase would be $48.60 per day. The total cost per year at 1% would be $177,390 and of each 0.1% would be $17,739. This, on operations which actually show a profit of $7,500,000 per year (after making allowance for the impairment of the process to the extent of $1,000,000 by the addition of non-mineral-froth-forming oils) is not a large factor. It shows how little of the decrease in profits is due to the increased cost of oil.

The Utah Copper Company at its two great plants, the Arthur and Magna plants, uses a mixture which is very much cheaper than defendant's mixture, but the elements of the calculation which would give the true relation of oil cost to the other factors of operation are not supplied in the record.

Defendant's brief at pages 59 and 60 cites the case of *Union Metallic Cartridge Co.* vs. *U. S. Cartridge Co.*, 112 U. S., 624, wherein this Court, speaking by Mr. Justice Blatchford found it impossible to hold that a plain mechanical equivalent of a patented invention infringed the patent, for the reason that the patentee had entered a specific disclaimer of that particular equivalent and then the brief adds

> "The same reasoning applies in this case. Having secured a favorable decision in this Court on the allegation that a larger amount of oil *is not* the equivalent of the 'critical proportions,' plaintiffs will not be 'heard to allege' that a larger amount of oil *is* the equivalent of the 'critical proportions.' This 'question of fact is not open now.'"

But the "larger amounts of oil" under discussion in the two cases were not the same thing. In the Hyde case the larger amounts of oil under discussion were 72 pounds of cottonseed oil and oleic acid and 36 pounds of oleic acid, and the arguments that were then made with respect to them were not that they were or were not the equivalents of any thing else, but that they represented nothing in the prior art and failed in the mill. The larger amounts of oil now under discussion and that the defendant's brief refers to are mixtures employed by the defendant and by its associated companies that we have heretofore fully discussed. Such mixtures present a very different question. The defendant's mixture is more than the equivalent of the plaintiffs' recommended proportions and quality. It *is* the plaintiffs' proportions and quality, the fuel oil and kerosene not doing the essential work of the process or taking any part in that work.

Defendant's brief seems here to concede the substantial equivalency of defendant's mixture with the plaintiffs' oil and to base its only argument on alleged estoppel by former arguments.

Oil Quality.

Defendant's brief on pages 3-62 presents an argument as to quantities of oil, ignoring quality altogether.

On pages 62-91 it presents an argument as to oil quality. In the Supplemental Brief for Petitioners, pages 127-140 petitioners present and discuss this, which is the only relevant issue,

> "The petroleum oils used by defendant are not mineral-froth-forming oils with defendant's ore"

Reference is made to this discussion for the presentation of the evidence upon the question of fact. Defendant's brief puts into our mouths a proposition broader than is material and broader than we assert, and then proceeds to answer that broader proposition.

It seems to admit the logic of our argument of infringement when it says (page 63):

> "The Court of Appeals was never asked by the defendant to find, and it did not find, that anything inactive in the process should be included in determining the amount of 'oil' used."

This is our contention, if it be understood that the phrase "anything inactive in the process" means anything incapable of effectuating the process, and as a matter of fact that is the sense in which we have used the terms "inactive" and "ineffective"—anything that does not have the bubble-modifying action (described by this Court) by which action alone the lifting and flotation by the buoyancy of air are achieved (which operation is also described by this Court) and the resulting froth concentrate carrying the metal is obtained (which result is also described by this Court).

The petroleum oils that are used by the defendant are fuel oil and kerosene and their equivalents. The defendant has not used petrol or its American trade equivalent gasoline, nor lubricating oil, nor have any of defendant's allied companies for that matter. They should therefore be eliminated from the discussion. The only question is the question of fact, whether the fuel oil and kerosene in defendant's process act to effectuate that process, that is to say, act to produce the mineral-air-froth. On that question of fact nothing that defendant's brief recites on pages 62-91 is material.

Defendant asserts on page 63 as follows:

> *"Defendant denies that the petroleum constitutent of its mixture of oils is inactive or ineffectual in the process."*

But that is an insufficient denial. Defendant's process involves substantially the same quantity and exactly the same quality of oil (to wit, pine oil) that its prior procedure involved, which is admittedly an infringement, and the same result in kind is produced by the same operation, and this is

not denied. Petitioners proved at the trial that the other oils used by defendant were not bubble-modifying oils and did not achieve the process in suit. The burden, therefore, was on defendant to establish that the fuel oil and kerosene of its mixture effectuated its altered process and produced the mineral-air-froth which is the result it obtains, or shared in effectuating the process (meaning the essential functions and operations that constitute the process), if it is to avail itself of the oil quantity argument it makes in the first 60 pages of its brief. It would not be enough for defendant to prove that its petroleum or its kerosene, or both, improved the character of a froth that was otherwise produced. It must indeed prove that the *fuel oil* which constitutes considerably more than half of its total mixture effectuated or had a part in effectuating the fundamental process; otherwise its entire oil quantity argument has, on its own admission, no application to the case whatever.

The question is not a question of law to be determined on the face of the patent, as appears to be suggested by defendant's brief (page 64(a)) and as appears to have been the idea of the Circuit Court of Appeals. That discussion on page 64 wholly overlooks the fact that the language it purports to quote from "the claims" is found only in claims 1 to 4, and it wholly overlooks the most important part of all the claims, viz: the purpose and end of the whole process which is specified in every claim (in claims 9, 10 and 11 by disclaimer) as, for example, (claim 1)

> "agitating the mixture *until the oil-coated mineral matter forms into a froth*"

and again (claim 12)

> "agitating the mixture to *cause the oil-coated mineral to form a froth*"

and again (claim 5)

> "agitating the mixture until the oleic acid has been brought into efficient contact with the mineral *and has formed a froth therewith*"

And it overlooks the fact that the whole end and object of the invention as described in the specification is the froth that the mineral matter is to form on the surface of the pulp (Specification, p. 1, lines 33-35, lines 89-91, lines 98-100; page 2, lines 4 and 5, lines 25 and 26, lines 40 and 41, lines 43 and 44, lines 113-115; page 3, lines 27-30).

And it overlooks the fact that a preliminary test is said to be necessary with each new ore (p. 1, lines 67-69)

> "to determine *which oily substance* yields the proportion of froth or scum desired"

As a matter of law, this specification and these claims manifestly require and demand such an oil as will respond to such a test and fill the measure of such a description and achieve the end specified in each claim.

This puts the public upon inquiry as to each new ore and it becomes as to each new oil in association with each new ore merely a question of fact whether that oil will achieve the process and result at all or not, and if so in what quantity will it best achieve the process and result. This is the prescription of a test that is at once a qualitative discrimination and a quantitative discrimination.

Defendant's brief on page 73 seems to assert that petitioners admit that the fuel oil and kerosene in the defendant's process assist in effecting concentration.

This is a misapprehension of our position.

So far from admitting that the fuel oil and kerosene as used by defendant assist in effecting concentration we proved at the trial that they were incapable of effectuating the process and that they not only did not assist in effecting concentration but actually diminished its efficiency.

The evidence on that question of fact is presented by us in Supplemental Brief for Petitioners both in discussion of the

facts of infringement (pp. 93-112) and of the further specific question of fact that the petroleum oils used by defendant are not mineral-froth-forming oils with defendant's ore (pp. 127-140).

Defendant's brief contains at page 87 serious error as to fact. It says:

> "Indeed, when defendant was using oil in quantities in the neighborhood of 0.1% on the ore, it used a mixture of which petroleum was a constituent."

The fact is, as the evidence shows, that when defendant used oil in quantities in the neighborhood of 0.1% on the ore, that is, prior to January 7, 1917, *it did not use a mixture of which petroleum was a constituent,* but on the contrary it had used at first oleic acid alone, then oleic acid mixed with pine oil, and then pine oil alone, and for the two years immediately prior to January 1, 1917, it had used pine oil alone.

Defendant's brief continues:

> "Plaintiffs' counsel make a point of the fact that when defendant was using oil in quantities of about 0.1% on the ore, its mixture contained only about 10% Jones oil, which is a petroleum (Tr. Vol. III, p. 1449, Q44)."

This reference is to the testimony of Mr. Wicks as to what was done in the mill of the Chino Copper Company at Hurley, New Mexico, and it had no reference whatsoever to what was done by the defendant.

A further error of fact in this discussion in defendant's brief appears at page 71, wherein it is said

> "the Inspiration Company finally adopted as a standard 'wood-tar oil known as Stockholm tar, mixed with certain *mineral oils*' in quantities in the neighborhood of 1% on the ore (Tr. Vol. V, p. 2264, Q14 and Q17)."

Q17 of the testimony referred to it as follows:

> "Q17. And in what proportion did you use this mixture of Stockholm tar and mineral oil?

A. The average was about two pounds per ton of ore treated."

This is 0.1% and not 1% as defendant's brief erroneously states.

Further, the operations described were not at the Inspiration Copper Company, but at the Britannia Mining & Smelting Company, now the Howe Sound Company (p. 2264, Q9), as should be noted by way of correction.

In defendant's brief at page 72 there is another error of fact. Referring to the testimony as to operations of the great Anaconda Company, a licensee, it says

> "the best mixture was shown by test to be composed of *'kerosene,* sludge acid, wood cresote, and *stove oil'* (Tr. Vol. V, p. 2384, '2')".

The word kerosene is italicized. It is true that the printer has placed a comma between "kerosene" and "sludge acid" in the printed record. This is one of some three thousand errors made in printing the record for the Circuit Court of Appeals. It was overlooked in making corrections. The context, however, in its repeated reference to "kerosene-sludge acid" otherwise referred to as "sludge acid," otherwise referred to as "kerosene acid sludge," makes it quite clear that the witness was referring to this peculiar substance, which, as the witness states, "is not kerosene" but "is simply the impurities taken out of the kerosene" (Vol. V. p. 2401, RQ110-112).

A correction of the heading on page 98 of Defendant's brief should be made It makes a statement as to the operations of defendant and then supports it by referring to and discussing testimony that does not relate at all to operations of defendant but to operations at the Magna plant at the Utah Copper Company, a subject considered in our supplemental brief, pages 182-184.

Defendant's brief repeats at pages 83 and 84 the wholly incompetent description by defendant's counsel which was also

included in the Brief for Respondent in opposition to the Petition for Writ of Certiorari, pages 23 and 24, of the visual observations by defendant's counsel of certain of plaintiff's illustrative experiments before the Circuit Court of Appeals. This appeared originally in a footnote to the printed oral argument of Mr. Bull. Defendant's brief (p. 85) suggests that there was no adequate denial of these statements in plaintiffs reply memorandum thereafter filed. Responding to this challenge we print the following pertinent excerpt from that reply memorandum:

> "The conclusions of the footnote based on the last three of appellee's demonstrations are equally unjustified. We will deal with them more in detail because the blunder in the observations of appellant's counsel on which those conclusions are based might not be entirely obvious to one who is not expert in recognizing the froth of the process in suit and in distinguishing it from spurious froths.
>
> "Mr. Bull and Mr. Fish [who argued defendant's case in the Circuit Court of Appeals] were not of counsel for defendant at the time of the trial in the Court below and neither one of them was present at any time during the trial, and neither one of them saw any of the demonstrations that were made during the trial * * *. These gentlemen are not competent to determine from observation what is and what is not the froth of the patent in suit. *Indeed, in one of the appellees' demonstrations Mr. Bull saw the froth of the patent before any oil of any kind had been introduced.* It was at the beginning of the first of the three experiments of appellees' that are discussed in the footnote. The Court will remember that Mr. Bull called attention to what he thought was the froth of the patent, being a foam that appeared on the top after the preliminary mixing and before the addition even of the kerosene oil, and that he demanded that the operation be repeated for full observation, and only desisted when his attention was called to the fact that no oil of any kind had as yet been added. *To his untrained and unaccustomed eye the metallurgically worthless foam that appeared at this time was the froth of the patent.* Actual analysis in the laboratory or the determinative test of practical use

> in the mill at once distinguish between the real mineral-carrying froth of the patent and a spurious metallurgically useless foam, or spume, or magma. The experienced metallurgist, trained in this process in the mill, and the experienced mill man who has to do with it there, acquire remarkable skill in the recognition of the true mineral-carrying froth from its appearance to the eye and from its behavior. But to the unskilled eye of the layman the difference is not manifest and all foamy appearances look more or less alike, whether they be (1) metallurgically useless foams or froths containing both mineral and gangue together unconcentrated, or (2) metallurgically useless oil pastes or magmas inflated with air or gas, or (3) metallurgically useful mineral-carrying air froths."

DEFENDANT'S COURT EXPERIMENTS WITH KEROSENE CONTAMINATED BY A SOLUBLE FROTHING AGENT.

Defendant's brief discusses this subject at pages 78-82, commencing on the last line of page 78. It is discussed as relating to a single experiment by Dosenbach, alleged to represent the Kirby process. In fact it applies to all kerosene experiments made in Court by defendant and casts suspicion on every oil from defendant's mill. The discovery of the contaminated condition of the kerosene used was made in connection with an experiment by Phillips in a bar-mixer, and it was then found, that Dosenbach's kerosene was similarly contaminated. The facts are presented in the Supplemental Brief for Petitioners, pages 141-143, and briefly referred to in Brief for Petitioners, page 14.

Defendant's brief admits (p. 79) that

> "the kerosene used in these experiments did contain a trace—a mere trace—of something soluble in water, which may have been, we admit, pine oil,"

but denies that it was present in sufficient quantity to account for the result obtained. But Mr. Higgins not only testified that it "was sufficient to produce the result obtained" (Vol V, p.

2552, Q484), but duplicated the result in Court by adding 0.1% of pine oil to pure kerosene (p. 2552, Qs490-492).

Defendant's brief then (pp. 81-82) protests that "the Trial Court, we submit, erred in refusing permission to repeat the test" in surrebuttal with what was alleged to be purified kerosene, but *all exceptions* to admission or exclusion of evidence *were abandoned* by defendant in its appeal from the District Court to the Circuit Court of Appeals. No errors in the admission or exclusion of evidence were assigned on appeal.

Disclaimer.

Defendant's brief says, bottom of page 105, that Plaintiff's counsel admitted before the District Court in certain quoted passages that "the disclaimer unquestionably broadens the claims" and then applies certain authorities which hold that a disclaimer cannot broaden the claims of a patent, meaning thereby, cannot broaden them as contrasted with what they were before disclaimer.

Now the statement, improperly called an admission, had to do, not with the disclaimer but with the decision of this Court in the Hyde case, and characterized it as a broadening decision—not broadening the patent or its claims from what they had been before, but broadening the conception of the invention and patent that had been expressed by the Circuit Court of Appeals in the Hyde case and by Judge Bradford in the Miami case. The Circuit Court of Appeals in the Hyde case had held the whole achievement of the patentees a mere oil-saving achievement in an old process, assuming without discussion that anything below one per cent. of oil involved the saving claimed. Judge Bradford found that a new process had been evolved having a new function, operation and result, and held that a patentable invention had been made, but he accepted without discussion the idea of the Circuit Court of Appeals for the Ninth Circuit that one per cent. of oil marked the limits of the invention in every case, and he declared claim 9 invalid, because it was not in terms confined

to the use of a fraction of one per cent. of oil, although with some discussion of the doctrine of equivalents as applied to the other claims (237 Fed., 630, 631).

This Court, too, found that a new and patentable process had been achieved and based this holding upon the fact of novel function, operation and result, but said that the patent must be confined to the results obtained by the use of oil in a fraction of 1%, and held claims 9, 10, and 11 invalid. This seemed to reject the ground on which Judge Bradford had held claim 9 invalid, and to substitute a broader ground, and thereby, as the Circuit Court of Appeals for the Third Circuit in the Miami case subsequently said "the question of infringement was actually enlarged" (244 Fed., 757).

Defendant's brief says (p. 106) that this Court said in the Hyde case that Claims 9, 10 and 11

> "were too broad because they included the use of any 'small quantity' of oil."

This Court did not say why they were too broad nor that they were too broad in regard to oil quantity. Rather the context indicates that they were held to be too broad in regard to the results obtained (as we have just above pointed out), in that they were not confined to the results obtained by the use of oil in a fraction of one per cent. on the ore. The disclaimer so confines them and in the very language of the Court, and thereby fully and exactly meets the Court's criticism, however that criticism be understood and construed, and aligns them with the other claims that were upheld as valid.

It is clear that the disclaimer does not, and cannot, broaden the claims with respect to what they were before disclaimer but narrows them; for this Court has authoritatively determined that from the beginning they were broader than the invention. And now they are expressly confined to it. They are, however, broader than the conception the Circuit Court of Appeals for the Ninth Circuit in the Hyde case had of the

invention or has now of the invention, and broader than Judge Bradford's conception, but only because, and to exactly the extent that, this Court's definition of the invention expressed in the Hyde decision is broader.

The disclaimer does not change claims 9, 10 and 11 from claims for processes into claims for *results per se* (as suggested on p. 107 of Defendant's Brief) any more than the decision of this Court changed the whole patent into a patent for *results per se;* and it is idle to so argue.

The disclaimer adopts the language of the decision and means in legal effect what the decision means and could not have been put in any other language than it was put without going beyond the decision. As it is, the disclaimer leaves claims 9, 10 and 11 good and valid for the full measure of the invention as upheld by this Court without any artificial or unnecessary limitations whatever.

New York, N. Y., March 17, 1919.

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERAL SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited,
Respondent.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

SUPPLEMENTAL BRIEF FOR PETITIONERS.

Parties, Pleadings and Proceedings.

Parties. The petitioners, plaintiffs, are Minerals Separation, Ltd., a British corporation, the legal owner of the title to the patent in suit, Minerals Separation American Syndicate, Ltd., a British corporation, owner of a residual right to profits

and damages for infringement up to October 10, 1913, and Minerals Separation North American Corporation, a domestic (Maryland) corporation, owner of the entire beneficial interest in the patent in suit and all rights to profits and damages other than the residual interest of Minerals Separation American Syndicate, Ltd. The respondent, defendant, Butte & Superior Mining Company (formerly Butte & Superior Copper Company, Ltd.), is an Arizona corporation having an established place of business in Butte, Montana, where it has committed the acts of infringement complained of.

Proceedings Prior to Trial. Suit was commenced on October 10, 1913, with Minerals Separation, Ltd., as the sole plaintiff, and proceedings for a preliminary injunction by reason of the prior decision of Judge Bourquin in the Hyde case (207 Fed., 956), resulted in an opinion and order entered November 14, 1913, denying preliminary injunction, provided the defendant filed a bond in the sum of $75,000, and monthly verified statements setting out the operations of its flotation plant. The defendant filed the bond, and filed monthly reports until June 27, 1918, when, following the decree and mandate herein of the Circuit Court of Appeals, all proceedings for the security of petitioners were suspended.

At the hearing on the motion for preliminary injunction the pleadings and proceedings in the suit of Minerals Separation, Ltd., and Minerals Separation American Syndicate, Ltd. vs. Hyde were offered in evidence in behalf of the plaintiff, and at the suggestion of the defendant were received in evidence for all purposes in all proceedings in the present suit (Vol. I, pp. 117, 118).* At the trial the Record of that suit in the District Court was offered in evidence (Vol. III, p. 1342), and it is reprinted in the present Record (Vol. I, p. 118—Vol. III, page 1334).

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*The references in this brief will be to the printed Transcript of Record unless otherwise noted.

Unless otherwise noted, bracketed portions and italicizing in quotations will be petitioners'.

Pending the decision of this Court in the Hyde suit the plaintiff took depositions of witnesses proving infringement, these depositions being in evidence (Vol. III, page 1370) and printed (Vol. VI, pp. 3088-3096).

On November 23, 1916, after the argument in this Court of the Hyde case but before the decision of this Court therein, plaintiff petitioned the District Court in the instant case for an increase in security and other relief in view of the inadequacy of the bond as shown by the reports of the monthly operations of the defendant. When this petition was presented, defendant moved to vacate the order requiring monthly statements and to vacate the bond. Judge Bourquin decided that the then unreversed decree of the Circuit Court of Appeals in the Hyde case, adjudging the invalidity of the patent, was the law of the Ninth Circuit, and denied plaintiff's petition and granted defendant's motion. His opinion is reported in 237 Fed., 401.

On January 13, 1917, after the decision of this Court in the Hyde case, the order for monthly statements and for the bond was reinstated by Judge Bourquin, and the time of trial assigned.

Pleadings. The bill of complaint was filed October 10, 1913 (printed, Vol. I, pp. 1-5).

The answer filed October 28, 1913 (printed, pp. 7-17) sets up all of the defences of the Hyde suit and no other defences.

On March 27, 1917, about three weeks before the trial, the defendant filed a supplemental answer (printed, pp. 17-21), setting up the decision of this Court holding claims 9, 10 and 11 of the patent in suit to be invalid, and averring that the plaintiff had unreasonably neglected and delayed the filing of a disclaimer, and that therefore the whole patent was void, and also averring that plaintiff was estopped from asserting that the patent was infringed by the use of an amount of oil exceeding one-half of one per cent. on the ore, by reason of certain statements made by counsel in the course of the argument of the Hyde case in Supreme Court of the United States. It may be

noted that the disclaimer happened to be executed in New York City on the day when this supplemental answer was filed in Butte and was filed in the Patent Office on the following day, March 28, 1917 (pp. 60-61).

On April 17, 1917, the second day of the trial, defendant filed an amendment to its answer (printed, pp. 21-25) which in substance merely added the California Journal of Technology of November, 1913, as an alleged further anticipation of the patent in suit.

During the trial, on May 1, 1917, with leave of the court (Vol. IV, pp. 1960-1962) the plaintiffs filed a supplemental and amended bill of complaint (Vol. I, printed, pp. 38-43), bringing in the additional parties Minerals Separation American Syndicate, Ltd., and Minerals Separation North American Corporation, and pleading the disclaimer filed March 28, 1917, and charging continued infringement of claims 9, 10 and 11, as limited by said disclaimer, and of claims 1, 2, 3, 5, 6, 7 and 12 (pp. 40, 41, par. 7). This supplemental and amended bill of complaint also pleaded the final decree in the Hyde suit and charged that the defendant in the present suit conducted and controlled the defence in the Hyde suit and was bound by the final decree in the Hyde suit. This latter contention was, however, abandoned by the plaintiffs at the close of the testimony (Vol. V, p. 2685), so that the present suit might be decided wholly on the merits.

Issue was joined on the supplemental and amended bill of complaint on May 4, 1917, by answer to the supplemental bill of complaint (Vol. I, pp. 63-68) and by answer to bill of complaint as amended (pp. 71-87).

Trial. The trial in open court commenced on April 16, 1917, and testimony was closed May 15, 1917, the twenty-fifth day of the trial. Oral arguments were presented at two extended sessions on May 16 and May 17. Thus the proceedings in court from beginning to end occupied twenty-seven days, practically five weeks. Additionally, however, the defendant gave an evening magic lantern exhibition of photographic slides in evidence, with explanations by Professor Taggart, on April 30,

1917 (Vol. IV, pp. 1948-1960). Additionally also the plaintiff exhibited the moving pictures in evidence to the court at an evening session on May 11, 1917, with explanations appearing in full in the Record (Vol. V, pp. 2511-2538). Further, on the afternoon of May 15, at the conclusion of the evidence, the court, on the invitation of the defendant, visited defendant's plant and inspected defendant's operations there proceeding in the presence of plaintiffs' counsel and representatives, and on the same afternoon at the invitation of the plaintiffs visited the Timber-Butte mill, of a licensee of the plaintiffs (Elm Orlu Mining Company), and inspected the plaintiffs' process there proceeding in the presence of defendant's counsel and representatives (Vol. V, p. 2686). Also during the trial numerous experiments, some fifty in all, were performed in illustration of the testimony, with all materials used divided between the parties in open court for analysis and assay, and all products similarly divided, for analysis and assay, except in the few instances where visual examination by the expert metallurgists of both parties was sufficient, and opposing parties did not request specimens of products. The analyses and assays were proved in evidence.

Opinion and Decree of District Court. The trial was followed by the filing of the findings and opinion of Judge Bourquin on August 25, 1917 (Vol. I, p. 93; opinion reported 245 Fed., 577) in favor of the plaintiffs (petitioners) both as to validity and infringement. The findings and opinion are fully considered in petitioners' main brief (pp. 31-52). The decree (Vol. I, p. 102) adjudged validity and infringement and directed an injunction and accounting. The period of infringement was divided into that "to and including January 7, 1917," of all the claims in issue, and that from January 7, 1917, "down to and through the time of trial," of all claims in issue except the "oleic acid" claims (claims 5, 6 and 7).

Stay of Injunction. The injunction was stayed pending appeal upon conditions set forth in petitioners' application to

this Court to restrain the defendant from disposing of its assets pending action on the Mandate of this Court, and, as set forth in that application, all proceedings for the security of petitioners were suspended upon the filing in the District Court of the Mandate of the Circuit Court of Appeals.

Opinions of the Judges of the Circuit Court of Appeals. Defendant appealed to the Circuit Court of Appeals, and the appeal was argued in March, 1918, before Judges Ross, Morrow and Hunt. Thereafter, on May 13, 1918, were filed the opinion of the Court by Judge Ross (Vol. VI, p. 3102; Appendix to Petition for Certiorari, p. 23), a concurring opinion by Judge Hunt (Vol. VI, p. 3107; Appendix to Petition, p. 32), and an opinion concurring in part and dissenting in part, by Judge Morrow (Vol. VI, p. 3109; Appendix to Petition, p. 37; see also, for all opinions, 250 Fed., 241).

Decree of Circuit Court of Appeals. Pursuant to the opinions of the majority of the Court, a decree was recorded and filed on the same day (Vol. VI, p. 3100) reversing the decree of the District Court *in toto* and directing the dismissal of the bill. This decree, as recorded and filed, does not appear in the record, for the reason that it was amended to its present form, after recording and filing (as noted thereon, Vol VI, p. 3112), in accordance with the Order Modifying Decree (Vol. VI, p. 3113; Appendix to Petition, p. 42). Thereafter counsel for defendant sent the following telegram to the Court:

"New York, N. Y., May 16, 1918.

Hon. F. D. Monckton, Clerk U. S. Circuit Court of Appeal,
San Francisco, Cal.

In Minerals Separation vs. Butte and Superior the Judges considered only the period subsequent to the decision of the Supreme Court of the Hyde case when they said that it is conceded that appellant has not used oil in

quantity as small as one-half of one per cent. The oral argument indeed related only to that period but the fact is *it is admitted that prior to January 7, 1917, appellant used less than one-half of one per cent. of oil* as stated in *appellant's brief*, page 2 and *appellees' supplemental brief* pages 126 to 128 where references to *the Record* will be found. We desire respectfully to call the attention of the Court to this matter and ask you to show this telegram to Judges Ross, Hunt and Morrow who *may wish to modify their opinion and judgment to award an injunction with respect to the use of oil in the quantities of one-half of one per cent. or less and an accounting with respect to appellant's practices during the period when it used less than one-half of one per cent. of oil.* We have handed copies of this telegram to appellee's counsel.

Thomas F. Sheridan
Frederick P. Fish
J. Edgar Bull"

Order Modifying Decree. Thereupon, without further argument, the following Order Modifying Decree was recorded and filed on May 20, 1917 (Vol. VI, p. 3113; Appendix to Petition, p. 43):

"Understanding from the presentation of this case that the real and pivotal question for the decision of this Court was whether or not under the decision of the Supreme Court in the case of Minerals Separation, Ltd. vs. Hyde, 242 U. S., 261, the use of any oil by the appellant in quantity of one per cent. or less on the ore, constituted an infringement of the appellee's patent, and that the fact was undisputed that the appellant had not used as little as one-half of one per cent. of oil in its process, *in reversing the judgment of the court below we directed that court to dismiss the bill at the complainant's cost.*

"Inasmuch, however, as it appears *and is admitted* that prior to and including January 7, 1917, the appellant did use in its process oil in quantities of one-half of one per cent. and less, thereby in those instances infringing the patent of the appellees.

"It is hereby ordered that the judgment of this Court herein rendered and entered May 13, 1918, be and hereby is *corrected* so as to read as follows:

> "The decree appealed from must be and is reversed and the case remanded with directions to the Court below to so modify its decree as to accord with the opinions of the majority of this Court, the appellant to recover its costs on this appeal."

Judge Morrow dissented as to costs.

The concluding paragraph of the filed opinion of the Court, by Judge Ross, in its *original* form was as follows (Appendix to Petition, p. 32, footnote):

> "Inasmuch as it *appears without dispute that the appellant company has never used in its process any oil in quantity as small as one-half of one per cent.*, it results from the views above expressed that the judgment must be reversed and the case remanded with directions to the court below to dismiss the bill at the complainants' costs, without regard to the question raised respecting the sufficiency of the disclaimer filed by the appellees company or to its resultant effect.
> *"It is so ordered."*

Upon the entry of the Order Modifying Decree this concluding paragraph was changed to the following form (Vol. VI, p. 3106; Appendix to Petition, pp. 31, 32):

> "It results from the views above expressed and from the similar ones expressed in the concurring opinion of Judge Hunt, that the decree appealed from must be and is reversed and the case remanded with directions to the court below to *so modify its decree as to accord with the opinions of the majority of this Court*—the appellant to recover its costs on this appeal."

The recorded and filed decree of the Court was also amended in like manner, as is noted in the endorsement thereon (Vol. VI, p. 3112). Thus a decree of complete reversal of the decree of the District Court, upon a finding of non-infringement, with direction for dismissal of the bill, was altered into a decree affirming the decree of the District Court as to validity

and affirming the decree of the District Court as to infringement by the acts of the defendant prior to and including January 7, 1917, but reversing the decree of the District Court as to infringement since January 7, 1917. Specifically the decree, as thus modified and amended, affirms the decree of the District Court as to validity of all the claims in issue, claims 1, 2, 3, 5, 6, 7 and 12 and claims 9, 10 and 11 as limited by disclaimer, and as to infringement of all claims in issue by the acts of the defendant prior to and including January 7, 1917, but reverses it as to infringement by the acts of the defendant since January 7, 1917.

Petition for Certiorari. Thereupon plaintiffs petitioned this Court for a Writ of Certiorari to review the decree of the Circuit Court of Appeals, and such writ was granted (Vol. VI, p. 3115), and the case was brought to this Court for review and determination.

Prior Adjudications.

The following is a full list of prior adjudications wherein the process here in suit has been in issue:

British Ore Concentration Syndicate, Ltd., vs. Minerals Separation, Ltd., 25 R. P. C., 741, High Court of Justice, Chancery Division; affirmed after intermediate reversal in the Court of Appeals by the House of Lords in

Minerals Separation, Ltd., vs. British Ore Concentration Syndicate, Ltd., 27 R. P. C., 33.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, Ltd., Supreme Court, New South Wales, 31 R. P. C., 216, 217.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, 31 R. P. C., 206, Privy Council British Empire.

Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956 (D. C. Montana).

Hyde vs. Minerals Separation, Ltd., 214 Fed., 100 (C. C. A., 9th Circuit).

Minerals Separation, Ltd., vs. Hyde, 242 U. S., 261.

Minerals Separation, Ltd., vs. Miami Copper Co., 237 Fed., 609 (D. C., Delaware).

Minerals Separation, Ltd., vs. Miami Copper Co., 244 Fed., 752 (C. C. A., 3rd Circ., including dissenting opinion of Judge Buffington, p. 775).

The present suit is the *fifth litigation* involving the process in suit. In the *first* (*British Ore Concentration Syndicate, Ltd.*, vs. *Minerals Separation, Ltd.*, finally decided by the House of Lords of Great Britain, on November 16, 1909) Minerals Separation, Ltd., one of the plaintiffs herein, was the defendant, and the alleged act of infringement was the use of the process in suit. The plaintiff in that suit was the owner of the Elmore British patents, corresponding to the Elmore patents in evidence herein, and the charge of infringement was finally limited to the second or A. S. Elmore patent corresponding to U. S. patent No. 689,070 (printed Vol. III. pp. 1243-1245). The Trial Court and the House of Lords decided that the use of the process here in suit was not an infringement of this Elmore patent, and was a new method of separation.

The *second* suit, *Ore Concentration Co., Ltd.*, vs. *Sulphide Corporation, Ltd.*, was brought by the owners of the Elmore Australian patents against a licensee of the plaintiff, Minerals Separation, Ltd., and infringement was charged by the use of the process in suit. No plaintiff herein was a party to that suit. The trial "occupied thirty-one days" (31 R. P. C., 214) and the trial judge, Chief Judge in Equity Simpson, found again that the process in suit was a new method of procedure and did not infringe. Here also the charge of infringement was finally limited to the A. S. Elmore, or second Elmore patent. Appeal was taken directly to the Privy Council of the British Empire, with the consent of parties, and the Privy Council affirmed the trial court.

The *third* suit, *Minerals Separation* vs. *Hyde,* started in the United States District Court of Montana, and was tried under the old equity practice. After final argument on pleadings and proofs Judge Bourquin decided that the patent in suit was valid and infringed. Appeal was taken to the Circuit Court of Appeals and the decree below reversed, on the ground that the invention was new only in degree and therefore unpatentable. A petition to this Court for a writ of certiorari was granted, and the case was reviewed in this Court, resulting in its opinion, rendered December 11, 1916, reversing the decree of the Circuit Court of Appeals and adjudicating the validity of the patent (as confined by the opinion) and infringement thereof.

The *fourth* suit, that of *Minerals Separation, Ltd.* vs. *Miami Copper Company,* was commenced in the United States District Court of Delaware and tried in open court therein and decided in the interim between the decision of the Circuit Court of Appeals for the Ninth Circuit in the Hyde case adjudicating the invalidity of the patent in suit, and the argument in this Court on the review of that decision. It was exhaustively tried in open court during the spring of 1915, the trial occupying nine weeks, and on September 29, 1916, Judge Bradford rendered the decision above cited adjudicating the validity and infringement of claims 1 and 12 of the patent here in suit, the invalidity of claim 9 of the patent here in suit, the validity and infringement of the second patent there in suit, known as the solution patent, No. 962,678, Defendant's Exhibit 218 herein (printed Vol. VI, pp. 2920-2923) and the invalidity of the third patent there in suit, not in evidence herein. Copies of this decision were handed to the Justices of this Court at the argument before this Court of the Hyde case, a month later.

Cross appeals were taken from Judge Bradford's decision in the Miami suit and were argued in the Circuit Court of Appeals for the Third Circuit at Philadelphia on January 30, 31, February 1, 2 and 3, 1917, occupying the entire time of the court for those five days. This argument occurred about a month and a half after the decision of this Court in the Hyde case. Plaintiff's appeal as to claim 9 of the patent here in suit

was abandoned, as this Court had reached the same conclusion as Judge Bradford with respect to this claim. The Court of Appeals of the Third Circuit affirmed Judge Bradford as to validity and infringement of claims 1 and 12 of the patent here in suit, and as to validity and infringement of the solution patent. They reversed Judge Bradford as to the third patent there in suit, adjudicating that patent to be valid and infringed. The court was divided, its opinion being written by Judge Woolley and concurred in by Judge McPherson, and Judge Buffington filing a dissenting opinion on the question of infringement of the patent here in suit by what were termed the second and third processes of the defendant, wherein pneumatic cells, known as Callow cells, were employed as the froth-separating devices.

The *fifth* suit is the instant case.

It will be noted that *in all five suits the trial courts have adjudicated the novelty of the invention here in suit,* and in the three suits based upon the patent here in suit, the validity and infringement of that patent. To like effect have been the adjudications of the three courts of absolutely last resort, the House of Lords of Great Britain, the Privy Council of the British Empire, and this Court. The Circuit Court of Appeals for the Third Circuit, whose decision was not subject to appeal, has also so adjudicated. *In all, nine courts have so decided, and five courts have specifically adjudicated the validity and infringement of the patent in suit.*

It is of interest to note that in the Miami case the defendant obtained a stay on mandate for the purpose of preparing a petition to this Court for a writ of certiorari, and then gave notice of abandonment of its intention to petition for a review of the decree. The accounting in that case is now proceeding, and that is the only case except the instant case not finally concluded.

Ore Concentration Prior to Patent in Suit.

There is in the instant case evidence additional to that in the Hyde case which very clearly sets forth the condition of the

practical art of ore concentration as it existed prior to the invention in suit. This particularly appears in the uncontradicted testimony of Professor Charles H. Fulton, a metallurgist of wide experience (Vol. V, pp. 2435-2443).

Ore concentration as it existed prior to the patent in suit, and as it still exists where the invention in issue is not being used, is dependent upon the settlement in water of particles heavier than water but having a different rate of sinking power in water. At the date of the invention of the patent in suit, March, 1905, the mining world had nothing at its disposal for concentrating ores except this metal-sinking process, known as the water concentration process (Fulton, Vol. V, p. 2436, Q3; p. 2443, Q10). The difficulty with this process is that sinking power is as much a function of size as it is of weight, so that although the metallic particles are heavier than the gangue particles, finely ground metallic particles will not sink with the larger metallic particles and will be carried away with the gangue (Fulton, pp. 2437, 2438).

Metals are found in nature associated with rocky particles of worthless matter or gangue, the gangue forming the matrix in which the valuable metallic particles are held. The purpose of ore concentration is such a separation of the valuable metalliferous minerals from the worthless gangue as will produce a concentrate sufficiently rich in valuable mineral for the subsequent process of smelting, this being true as to the ores of copper, lead and zinc, and to some extent gold and silver. The metals zinc and lead are found in the form of sulphides having a metallic luster, copper is found in the form of metalliferous sulphides and sometimes pure copper, and the same is true of silver and gold. These are the principal metals to which the process in suit is applicable.

It is the practice in this art to refer to the metal or metalliferous mineral as the "mineral" and to the rocky material, sand, clay, etc., as "gangue." This terminology appears throughout the record, and to some extent in the briefs.

The first essential of any treatment is the grinding of the ore, and this should be carried to such a point as to free the

metallic particles from the gangue particles, to produce in fact wholly separate particles of metal and gangue. But every process of crushing or grinding, no matter how carefully manipulated, produces great quantities of extremely fine particles called slimes. The finer the grinding the greater the proportion of the slimes. *If the crushing is coarse, the metals and gangue are not separated and the metal is very apt to go away with the gangue. If the crushing is fine, the great amount of metallic slimes produced will nearly all go away with the gangue.* This was the dilemma of the millman, and the slimes problem was so acute that coarse grinding was the rule. The metallic particles are usually much more brittle and friable than the gangue, so that the slimes were usually richer than the coarse particles.

Water Concentration. This process, above generally described, is the common process of ore concentration. It is in fact a process of washing the dirt or gangue away from the metal. It was the only process available to the mining world before the process of the patent in suit was invented, and is still in use where the process of the patent in suit is not in use.

Briefly it may be said that the water concentration process is carried on with a great amount of machinery—jigs with upward streams of water, and vanners, and shaking tables with streams of water flowing over them. The heavier metallic particles go to the bottom, while the lighter gangue particles, which do not sink so rapidly are flowed away in suspension by the water, and with them are flowed away the valuable metallic slimes. The great problem of the art preceding the invention in issue was the slimes problem, and that problem the invention in issue completely solved. It was quite usual in the prior art to deslime, that is to separate and throw away or dump the slimes, but whether they were separated and discarded before water concentration was attempted, or appeared in the tailings of water concentration, the result was the same, they were waste material rich in metal.

The evidence in the instant case includes, additionally to that in the Hyde case, references to and quotations from the literature of the art as published just prior to the invention in suit, showing its attitude toward the problems which were solved by the invention in suit.

The "foremost authority of the world on ore dressing, Professor R. H. Richards" (Fulton, Vol. V, p. 2438, Q3) in his standard text book on ore milling, "Richards on Ore Dressing," published in 1903, just a little more than a year before the birth of the invention of the patent in suit, gives us an excellent statement of this attitude of the art. From the extracts read from this standard work (pp. 2438-2441) it will be seen that the great problem of the art was the slimes problem, presenting to the millman the dilemma that if he ground too coarse he would not free the metal from the gangue, and if he ground reasonably fine he would lose great quantities of metal in the slimes which, by reason of the brittle character of the sulphide particles, were richer than the coarser material. In these quotations we find such statements as the following:

> "GREASINESS.—This is the term used to express the tendency of minerals to float on the surface of water as if they were greasy. It is caused by the aversion of the surface of the particle to become wetted. The particle may carry an air bubble down with it, which later floats it to the surface, or its dry surface may prevent its sinking at all, the particle floating at the base of a little dimple or depression on the surface of the water. This causes much trouble in ore dressing. * * * This property may be regarded *rather as a difficulty to be overcome than as a help,* for the reason that it cannot be depended upon—at one moment a given grain will float, at another it will sink" (Vol. V, p. 2440).

We also find the attitude of the art toward improvement as follows:

> "TENDENCY AND FUTURE.—The tendency is distinctly toward graded crushing, graded sizing and graded washing" (*ib.*).

That is to say, crush in several operations, deslime, and separate the crushed material into graded sizes, and wash it as thus graded. The following is the prophecy:

> "The *future progress* to be made in ore dressing *will probably be more in the development and perfection of existing processes and machines than in the introduction of new processes.* Not that new processes do not appear—for they are brought out constantly—but their disappearance is usually as sudden as their appearance" (*ib.*).

And this was in 1903. The engineers of the art looked for nothing better than improvements in water concentration methods, developments of the existing machines with slime losses minimized as much as possible. So-called greasy flotation, the tendency of minerals to float as if they were greasy, was merely a source of trouble, adding to the slime losses, and so uncertain as to be incapable of utilization.

Prior Oil Processes. In the book above referred to, a cyclopedic work on ore dressing, we should expect to find a reference to any departure from water concentration which had made the slightest impression on the art, and we do find here a reference to the Elmore oil-buoyancy flotation process (Vol. V, p. 2441) as a hope of the metallurgical art for those conditions where "there is only a slight difference in specific gravity between the mineral and gangue" (pp. 2440, 2441). Nothing else that the defendant refers to is mentioned in this resumé by Richards of the art of ore concentration almost contemporaneous with the birth of the invention of the patent in suit.

The other evidence as to actual use of prior ore-concentrating processes employing oil is that of the Hyde case. Briefly there were only two, both mill failures, the Elmore bulk-oil-buoyancy flotation process referred to above, and the Cattermole metal-sinking process.

Patent in Suit.

This patent No. 835,120, was issued November 6, 1906, to Sulman, Picard and Ballot.

The process of the patent in suit is an air-froth flotation process wherein, by the use of a frothing agent, and in the presence of such agitation as will maintain or produce distribution of the ore particles through the pulp and dissemination of bubbles of air through the pulp, the air bubbles will seize the metallic particles and will carry them to and through the surface of the pulp, so as to permit of their delivery at or above the surface of the pulp separate from the gangue particles, which remain in suspension in the pulp or sink to the bottom.

The process of the patent in suit is the pioneer process of this character.

In it the frothing agent is an oily liquid or oil immiscible or insoluble in the water of the pulp, and it is such an oily liquid or oil as will modify the air bubbles and effectuate the process. The oily liquid or oil coats the metallic particles and modifies the air bubbles so that they persist, and increases the attraction of the metallic particles for the air bubbles; and the persistency of the modified air bubbles and their attachment to the metallic particles are so great that the air bubbles carry the metallic particles to and through the surface of the pulp, and when the air bubbles are exposed at or above the surface of the pulp, their oil-contaminated water films, carrying the metallic particles, are maintained intact until their separation from the body of the pulp has been effected, by overflowing or otherwise.

The air bubbles carrying the metallic particles form a floating mass of bubbles pressed against each other, a coherent mass of froth, which may be several inches in thickness, upon the surface of the pulp. Under quiescent conditions, this froth may float for days and weeks. A quiescent froth of this character has therefore been called a persistent or permanent froth. On the other hand the air bubbles which carry the metallic

particles may be continuously overflowed, over a lip or dam, pressed upward by newly rising air bubbles, the froth being inflated by an excess of air bubbles arising from the use of air to agitate the pulp. Such a froth was produced by the defendant in the suit against Miami Copper Co. (*supra*, p. 10) from a lean copper ore and is produced by the defendant in the instant case in similar apparatus, known as Callow or pneumatic cells, used for the final treatment of mineral-depleted tailings. A quiescent froth such as first described is formed wherever in the mill a pulp which has been agitated and aerated in the presence of a frothing agent and from which the froth has not been removed, is brought to a condition of substantial or complete quiescence. The operations described in the Hyde suit, both of plaintiff and defendant, wherein the pulp was agitated in one chamber or vessel by rotating blades in an operation there described as "beating the air into the mass" (242 U. S., 265), and was then flowed into a froth-separating chamber or spitzkasten wherein the froth was permitted to rise and overflow, approximated the conditions for producing quiescent froth. With the rich zinc ore principally referred to in the testimony in that case, Broken Hill ore, about 50% metalliferous mineral content, and defendant's ore as then mined, fully 30% metalliferous mineral content, a froth heavily charged with mineral—heavily armored—was produced. But metalliferous mineral froth produced by the process in suit may be of varying degrees of persistency, depending upon the richness and character of the ore, and the amount of air, that is, the relation of the number of metalliferous mineral particles to the area of bubble surface, and also depending upon the mobility of the froth. All degrees, from the complete quiescence attainable in the intermittent operations of the laboratory and at places of quiescence in the mill, to the active froth produced in an air-charged froth-separating vessel, may be produced. Judge Bradford, the District Judge in the Miami case, gave very careful consideration to this subject (237 Fed., 632, 633) and in conclusion said (p. 633):

"Coherency and permanency in a froth admit of degrees, and such a degree as insures by air flotation an efficient and final separation between the metal and the gangue, whatever may be the duration of the froth, comes within the process of the first patent in suit."

The first patent there in suit is the patent here in suit. Judge Bradford was considering what took place in air-charged froth-separating chambers known as Callow cells. Defendant here uses that apparatus and supplies it with material that has been largely depleted of its metalliferous mineral content. Defendant here also uses so-called Janney mechanical machines (*infra*, p. 82), with agitating chambers wherein the air is beaten into the mass of pulp, and with froth-separating vessels or spitzkastens. These Janney mechanical machines are similar to those described in evidence in the Hyde suit, except for the much greater violence of their agitation, described by one of defendant's witnesses as producing "almost a mist" in the agitating chamber (Wicks, Vol. III, p. 1457, Q115) and admitted by another of defendant's witnesses to be describable as "terrific agitation" (Conrads, Vol. III, p. 1594, XQ387). The pulp, surcharged with an excessive amount of useless oil, first passes through these agitating chambers, wherein this "terrific agitation" is helpful in dealing with the useless oil. Defendant also uses, following the Janney mechanical machines, so-called Janney mechanical-air machines (*infra*, p. 83), which differ only from the mechanical machines in that the froth separating vessels or spitzkastens have porous false bottoms, like the Callow cells, whereby compressed air is forced into the pulp, and air-agitation supplements the terrific mechanical agitation. With these three types of apparatus defendant produces many variations in the degrees of coherency and persistency and consistency of metalliferous mineral froth, in every instance overflowing the froth and thereby recovering valuable metalliferous mineral.

The patent fully and completely discloses the invention, and gives to the pubic the best knowledge possessed at the time of

the filing of the patent application of the means for utilizing the invention, as abundantly appears in the record.

The important point as to discovery is truthfully stated to be that the inventors have found that a considerable reduction of oil from that required for the Cattermole granulation or metal-sinking process brings about the new process which the patent discloses and claims. The statement is as follows (Spec., p. 1, lines 28-35):

> "We have found that if the proportion of oily substance be considerably reduced—*say to a fraction of one per cent. on the ore*—granulation ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

This discovery is a historical fact, abundantly proved, and described in the opinion of this Court in the Hyde case (242 U. S., 266, 267).

The Cattermole patent Nos. 777,273 and 777,274 are specifically referred to (Spec., p. 1, lines 16-27) in the preceding paragraph, and thus the reference to the Cattermole process is made definite and precise.

It will be noted that *a fraction of one per cent. is here stated in the specification by way of example.* A considerable reduction below the proportions of the Cattermole granulation or metal-sinking process is a considerable reduction below what is necessary in each particular instance to produce the Cattermole operation of adhesion of the mineral into granules that sink. This was, for example 5% on the metalliferous mineral content of Broken Hill ore, that being the standard in the only practical use that was ever made of the Cattermole process (Chapman, Vol. I, p. 224, Q9). The smallest amount of oil ever used in the Cattermole process, even in the laboratory was 1½% on the ore (30 pounds to the ton of ore). Again, with defendant's ore and oleic acid, Dr. Liebmann effectuated the Cattermole process with from 1.8% to 2.1% of oleic acid on the ore, 6% and 7% respectively, on the metalliferous mineral,

as appeared in the evidence in the Hyde case (Vol. I, pp. 433, 434, Q36). Again, at the trial in the instant case, with defendant's ore more finely ground, Mr. Higgins effectuated the Cattermole process with 5% of oleic acid on the ore (100 pounds to the ton of ore) about 15% on the metalliferous mineral (Vol. V, pp. 2505, 2506, Qs315-328), with excellent results (Vol. VI, original paging 5562, 4th item).

As to the Cattermole process patent No. 777,273, this patent suggests, as this Court said "4 per cent. to 6 per cent. to ten per cent. of the weight of the metalliferous mineral matter" (242 U. S. 265), insists upon a large metalliferous mineral content, and *directs the user to determine by actual test and use the right amount of oily liquid or oil for carrying on its metal-sinking operation.* In fact this patent gives no less than seven different factors determining the amount of oily liquid or oil (*infra*, p. 161), and oil-quantity determination by "simple arithmetic," such as defendant applies in defiance of the disclosures of the Cattermole patent and of the facts proved, is futile.

In the specification of the patent in suit the various factors which contributed to the discovery are briefly stated, to wit: acidification (Spec., p. 1, lines 36-45), stated to be preferable "to render the selective action of the oil more marked" (Spec., p. 1, lines 43, 44); warming, to assist the process (Spec., p. 1, lines 51-56), and fine pulverization (Spec., p. 1, lines 56-61). As to fine grinding or pulverization, an illustration is given later on, in the specific example of carrying on the process with Broken Hill ore, and it is said that

> "If the ore were crushed to ninety mesh to the linear inch* (half of which ore will pass through one hundred and fifty mesh sieve)" (Spec., p. 1, lines 102-104)

the first froth obtained from a single agitation "may contain about seventy per cent. to eighty per cent. of the metalliferous matter present in the ore" (Spec., p. 1, line 105). This is an

*So that it would pass through a screen having ninety openings to the linear inch, each opening roughly one one-hundred and eightieth of an inch.

exact description of what took place in the tests made following the discovery of the new process. This was very fine crushing, finer than the prior art had dared to use, producing as stated a very large proportion, about fifty per cent. of what was practically slimes. As testified to by Mr. Higgins, the ores treated in 1905 were generally crushed to 30 or 40 mesh, and it was doubted whether the profits of the operation would sustain the cost of crushing to 90 mesh (Vol. V, p. 2510, Q362). Today with air-froth flotation, extreme fineness of crushing is the rule, and products which pass through 100 and 150 mesh screens are subjected to air-froth flotation (Higgins, Vol. V, p. 2510, Q362).

Different ores and different oils. In processes of ore concentration of wide application, a great variety of different ores is encountered. Each ore to some extent presents its own problem. As this Court said in the Hyde case (242 U. S., 271):

> "The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law."

The statement in the specification is as follows:

> "The proportion of mineral which floats in the form of froth varies considerably with *different ores* and *with different oily substances*, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine *which oily substance* yields the proportion of froth or scum desired" (Spec., p. 1, lines 61-69).

Mr. Chapman in the Hyde case (Vol. I, pp. 235, 236, Q51) well described the simple preliminary tests which are being made every day.

Thus the specification directed the defendant to test its ore for the purpose of determining a suitable oily substance and the proportions in which it should be used to give the best results of the process.

Defendant followed the specification in using pine oil. The first operations of the defendant followed exactly the example of the specification, using oleic acid well within the suggested proportion of from 0.02% to 0.5% on the ore. In August, 1911, defendant used oleic acid at 0.16% on the ore (Chandler, Vol. I, p. 189, Q15), as proved in the Hyde suit. Later another mineral-froth-forming oily substance, pine oil, was mixed with oleic acid in total proportions of 0.2% and less. This began in June, 1913 (Dosenbach, Vol. IV, p. 1964, XQs.442, 443), and continued until the end of 1914. Then pine oil was used alone, at about 0.08% (p. 1964, XQs.449, 450). This was continued during 1915 and 1916 (Q452), with an average each year of 0.07% on the ore (Vol. VI, facing p. 2882, original paging 5184, 5185). The process of the patent in suit was then used at greatest advantage and with the best results ever attained by the defendant. The directions of the patent had been explicitly followed.

Defendant did not follow the specification in its use of petroleums. On December 11, 1916, this Court decided that the patent was valid and that all such air-froth flotation operations as the defendant had theretofore and was then carrying on were infringements. The defendant then sought for a method of continuing to use the invention with attempted evasion of the patent. A mixture of oils was finally produced approximately of 70% of fuel oil, 12% of kerosene oil and 18% of pine oil (Dosenbach, Vol. IV, p. 1916, Q137), and was used at and about 1% on the ore. At 1% the proportion of pine oil was 0.18% on the ore, a little more than formerly to cope with the useless material poured into the pulp. The fuel oil and kerosene were unnecessary, as defendant's former operations demonstrated. Simple tests such as the patent directs and Mr.

Higgins made at the trial (Vol. V, pp. 2544-2549) would also have demonstrated their uselessness. Kerosene and fuel oil, separately or together, are not mineral-froth-forming oils. When agitated they do not produce a froth of oil-coated metalliferous mineral. Therefore, according to the disclosure of the specification of the patent in suit, as approved by this Court, the use of kerosene and fuel oil is the use of extraneous material, not to be taken account of, *mere camouflage*, which failed however to successfully disguise infringement of the patent by the use of pine oil.

Example of oleic acid with Broken Hill ore. The specification of the patent in suit next gives the example of the application of the invention to Broken Hill ore with oleic acid. It says:

> "The following is an example of the application of this invention to the concentration of a particular ore" (Spec., p. 1, lines 70-73).

The ore described is the well known ore of Broken Hill, Australia (Liebmann, Vol I, p. 446), which is the ore upon which the process was first tried and first used in practice.

This example of the application of the process with oleic acid to Broken Hill ore is described as conducted in "a cone mixer or the like, as in the processes previously cited" (Spec., p. 1, lines 83-85).

The processes previously cited are those disclosed in the two Cattermole patents referred to earlier in the specification (Spec., p. 1, lines 16-27). These processes are described as carried on the "cone mixer" or Gabbett.

The specification says that the ore pulp containing oleic acid

> "is briskly agitated in a cone mixer or the like, as in the processes previously cited, for about two and one-half to ten minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp" (Spec., p. 1, lines 83-88).

Agitation. Brisk agitation such as characterized the Cattermole process (in the identical apparatus and at the same speed of rotation of the cone) effected abundant aeration of the pulp. No change of speed or of character or degree of agitation accompanied the transition from the Cattermole process to the process in suit. Indeed the investigations immediately preceding the discovery were as to the "Influence of Peripheral Velocity of Cone" (Higgins' Report, March 2, 1905, Vol. II, p. 652), and included variations from 840 to 1462 revolutions per minute, with "oleic acid 1.5% on ore" and merely showed that granulation was more quickly effected at the higher speeds. These tests did not produce mineral-froth but only sinking granules.

The usual speed of cone for the Cattermole process at the time of the discovery was 900 revolutions per minute and this was the speed that was used in the oil-reducing experiments which produced the invention in issue. Mr. Higgins so testified at the trial (Vol. V, p. 2509, Q 358, quoted below), and this is the speed given in Mr. Higgins' report of March 2, 1905 (Vol. II, p. 651) of acidity-variation experiments just preceding the speed-variation experiments which just preceded the oil-reduction experiments. This was a slight reduction in speed from a standard speed of about 1000 revolutions per minute, used in September, 1903 (p. 622), eighteen months earlier.

High speed of agitation was introduced into the metallurgical art, not by the invention in suit, but by the Cattermole process. As Mr. Higgins testifies (Vol. V, p. 2509, Q351 *et seq.*):

> "Cattermole took an agitator from another art, and by increasing the speed to a very great extent he introduced into the metallurgical art the high speed agitation.
>
> Q.352. And what was the apparatus that Cattermole took from another art?
>
> A. The cone mixer or the Gabbett mixer.
>
> Q.353. And how had the mixer been used before Cattermole used it?
>
> A. It was used in the coal tar industry, to keep the coal tar in the still circulating from the bottom to the top or

from the top to the bottom so that the tar did not set in the still and char during the distillation. The Gabbett was also used at slow speed in cyanide work, keeping the cyanide solution and the pulp in solution. There again it was used as a slow speed agitator.

Q.354. And for the Cattermole process you say it was speeded up?

A. Yes, the speed was very much increased. Although that increase of speed had the effect of introducing a much larger quantity of air into the solution of whatever was being dealt with, that was not any great defect in the Cattermole process, as long as the granules were properly and efficiently made.

Q.355. So that with the use of the cone Gabbett in the Cattermole process as it was used there was such speed of agitation as to produce the introduction of considerable air into the pulp?

A. Yes, there was.

Q.356. And in the Cattermole operation what was the effect of that air in the pulp.

A. The effect of the air on the large granules was absolutely none. There was no attachment at all; but where you got badly formed granules, or some of the granules badly broken, you might get some air bubbles sticking to the granules, and it would so be carried upwards in the upcast, generally in suspension, but still making a defect in the process.

Q.357. So that the air worked against the process.

A. When it worked at all, it worked against the process, yes.

Q.358. But nevertheless as the record shows, the Cattermole operations were carried out in the Gabbett up to the speed that the Gabbett attained, which was the same speed that was useful in the process of the patent in suit?

A. Yes; we used to run the Cattermole Gabbett at about 900 r.p.m., and that was the same speed with which we first used the process of the patent in suit. The patent in suit says in the example that the mixture is warmed and briskly agitated in a cone mixer or the like, as in the processes previously cited, and the processes previously cited are the two Cattermole specifications."

The discovery of the invention in issue was made during the week from March 3 to March 10, 1905 (Ballot, Vol. II, p.

1016, Q18 and documents quoted). About two months later on May 3, 1905, Sulman and Picard reported as to a continuous apparatus which had been "arrived at" (Vol. II, p. 665), after "a very large number of experiments" of the intermittent character of the experiments described by Mr. Higgins which gave birth to the invention. In this continuous apparatus the speed was increased, from the 900 revolutions per minute of the discovery to "from 1000 to 1100 revolutions per minute as regards the cone" (p. 665). This fact was fully appreciated by this Court in the Hyde decision, wherein it is said (242 U. S., 267)

> "The extent of the agitation of the mass had been increased as the experiments proceeded until the 'series of Gabbett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,100 revolutions per minute'."

The quotation in this Court's opinion is from the Sulman and Picard report of May 3, 1905 (Vol. II, p. 665).

It seems quite clear that when this Court later speaks of (242 U. S., 268, 269)

> "air bubbles introduced into the mixture by the agitation greater than and different from that which had been resorted to before"

it was not comparing the process in suit with the Cattermole metal-sinking process, but with prior flotation processes, *e. g.*, Kirby. Nevertheless, the majority of the Third Circuit Court of Appeals believed that this Court had held that agitation "of greater intensity and longer duration" (244 Fed., 760) than anything in the prior art, was an essential feature of the invention, and the minority presents an elaborate argument to show that the patent was confined to violent agitation in a Gabbett mixer or equivalent machine (244 Fed., 775-792). This subject will be considered in connection with these opinions (*infra*, pp. 202-210), but the following quotation from the oral argument of Frederick P. Fish, Esq., counsel for de-

fendant, as delivered in the instant case at San Francisco, and reported by the Court Reporter (although not appearing in the revised printed Oral Arguments for Appellant), well states the situation:

> "I do not care what else there is in the process; as a matter of fact there is not much else except the agitation to the same extent that they had in Cattermole, or a little greater—no, the same extent they had in Cattermole, for I think my brother is right in it; when the Supreme Court spoke of the agitation here as being unusual, they meant unusual as compared with Froment, as compared with Kirby, as compared with Everson; they did not mean unusual as compared with Cattermole, because the record would not justify it. I think that is right."

One other point should be noted here as to agitation. The brisk agitation in a cone mixer or the like described in the example of the specification was the agitation employed at the time of the discovery with oleic acid and Broken Hill ore, and it is stated, as above quoted, that it is to be continued

> "for about two and one-half to ten minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp" (Spec., p. 1, lines 85-88).

Oleic acid is a viscous fatty acid, the dissemination of which through the pulp requires brisk agitation, and brisk agitation in a Gabbett mixer of such degree and duration as will disseminate oleic acid and bring it into efficient contact with all the mineral particles in the pulp, will also aerate the pulp to the necessary extent for froth formation. When the mineral-froth-forming oily substance is pine oil, an essential oil of low viscosity and easily disseminated through the pulp, the degree and duration of agitation for such dissemination is very greatly reduced, and froth flotation may well be effected by another method of agitation described in the patent in suit, to wit: by air bubbles liberated in the pulp (*infra*, pp. 33-37), or by the

equivalent means of the pneumatic cell or Callow cell froth-separating apparatus, such as was employed by the defendant in the Miami suit in connection with pine oil, and such as is employed by the present defendant in part of its process, also in connection with pine oil as the mineral-froth-forming oil.

Froth Formation. The specification of the patent in suit, after describing, in the example, the method and means of agitation to be followed with Broken Hill ore and oleic acid, describes what takes place at the conclusion of such agitation, as follows (Spec., p. 1, lines 89-96).

> "When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by the agitation, such bubbles or air-films adhering only to the mineral particles which are coated with oleic acid" (Spec., p. 1, lines 89-96).

Here we have described the production of a metal-carrying air-froth resulting from the introduction into and inclusion in the pulp of *air bubbles adhering to the mineral particles coated with oil,* i. e., resulting in the oil-modified air-lift.

The amount of oil described in this specific example is

> "a very small proportion of oleic acid, (say from 0.02 per cent. to 0.5 per cent. on the weight of the ore)" (Spec., p. 1, lines 80-82).

and the recommendation as to this specific example is

> "The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under 0.1 per cent. of the ore; but this proportion has been found suitable and economical" (Spec., p. 1, lines 96-101).

Thus for Broken Hill ore with oleic acid as the oil, and in the presence of a small proportion of "a mineral acid or acid salt" (Spec., p. 1, line 77) and with pulp warmed "say to 30°

to 40° Centigrade" (Spec., p. 1, lines 82, 83), the proportion of oleic acid recommended is "0.1% of the ore" (Spec., p. 1, lines 99, 100), and the limits suggested are say from "0.02% to 0.5% on the weight of ore" (Spec., p. 1, lines 80-82). Any attempt to ascribe to this language a limitation of the invention, in all its applications to all ores, to 0.5% on the ore as the maximum quantity, is wholly unjustified, and yet Judge Hunt cites this language as authority for that limitation in his concurring opinion (Vol. VI, p. 3107; Appendix to Petition, pp. 33, 34).

The disclosure of the invention is given

> "in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains * * * to * * * use the same" (U. S. R. S., Sec. 4888),

as has been adjudged by this Court. The inventors have performed their duty by filing such a description in their specification. It is not within the bounds of reason that having done so as to one application of their invention, they are to be limited by the details of that description as to every application of their invention.

Relative to the disclosure of mineral-froth-formation, it is to be also noted that the word "froth" is repeatedly used in describing the floating concentrate obtained by the process, as at page 2, lines 1, 5, 16, 20, 26, 41, 43 and 93, additionally to the earlier use of this word on page 1, lines 35, 56, 61, 62, 68, 91, 99 and 105. Also later in the specification in describing froth-formation by air-bubbles liberated in the pulp (*infra*, pp. 33-37), it is said that bubbles

> "so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth" (Spec., p. 2, lines 113-115)

and again

> "The whole of the mineral to which air bubbles are attached—say the oiled mineral—at once rises to the surface as a coherent scum or froth" (Spec., p. 3, lines 27-30).

This froth is also repeatedly described as composed of "oil-coated metalliferous matter," as at page 1, line 33, page 2, line 4, and in all of the claims except 9, 10 and 11 (and these claims, which originally described only "a froth" are limited by the disclaimer to a process wherein a froth of oil-coated metalliferous matter is formed). Variantly the expressions are "all the metalliferous matter in the form of a froth" (Spec., p. 2, lines 114, 115), the "oil-coated metalliferous matter removed as froth" (Spec., p. 2, lines 4, 5) and "the oleic acid or other fatty acid forming the coating on the metalliferous matter which produces the froth" (Spec., p. 2, lines 14-16). Again, in the description of the continuous apparatus shown in Figure 1 of the drawings, the Gabbett is described as "the frothing apparatus" (Spec., p. 2, lines 62, 63), and the spitzkastens as the "froth-separating apparatus" (Spec., p. 2, line 66).

The formation of air cells or submerged bubbles within the pulp, their selection of and attachment to metalliferous mineral particles and buoyant lifting of the metalliferous mineral particles, and their emergence from the liquid and formation above the surface of the liquid of a body or mass of froth carrying the metalliferous mineral particles, all controlled and modified by the oily frothing agent which coats the mineral and contaminates the watery films of the bubbles, these are the essentials in the functions and operations performed and in the results obtained. As this Court said in the Hyde case, adopting the language of Lord Atkinson (242 U. S., 269):

> "the lifting force is to be found, not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop or become attached to, the thinly oiled metallic particles, and raise them to the

surface, where they are maintained by what is termed the surface tension of the water."

And again, describing what took place at the discovery this Court said (242 U. S., 267):

> "This froth, on collection, was found to consist of air bubbles *modified* by the presence of the minute amount of oil used."

And again this Court described the resulting froth obtained, as (242 U. S., 265)

> "a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment."

Judge Bourquin's consideration of the action of bubbles "the heart of" the process, and of the "quality of oil" which enables it to "create bubbles" which will effectuate the process (Vol. I, pp. 94, 95), is quite fully quoted in petitioners' main brief (pp. 33-39). It presents the same conclusions as this Court, but they are further confirmed by the voluminous scientific and technical evidence in the instant case.

Removal of the Froth. As this Court said in describing the froth produced by the process in suit (242 U. S., 265):

> "This froth can be removed and the metal recovered by processes with which the patent is not concerned."

The description in the specification of froth removal is broad and comprehensive. The specification says (Spec., p. 2, lines 1-3):

> "This froth is removed from the pulp by spitzkast, upcast, skimming, draining, or otherwise."

The froth usually flows over a dam. In a spitzkasten this is called the overflow lip. Sometimes a revolving paddle or skimmer helps the froth over the lip. In a pneumatic cell the excess air assists, after the manner of an upcast, in overflowing the froth. Defendant uses spitzkastens with skimming blades, and also utilizes air upcasting both in several spitzkastens and in the pneumatic cells.

The part of the specification heretofore mainly considered, up to page 2, line 3, gives a complete disclosure of an operation embodying the invention. The disclosure is of carrying on the example in a Gabbett mixer, intermittently. In practice the process is carried on continuously. The discovery of the process was made in intermittent operations in a Gabbett mixer, but the inventors immediately set to work to devise continuously operating apparatus, and such an apparatus is diagrammatically shown in Figure 1 of the drawings and is described in the specification. This apparatus is no part of the invention, but will be considered later (*infra*, pp. 40-42).

The specification contains, however, two disclosures of modified procedures as to the method of introducing air and the kind and degree of agitation, which were of practically no importance in the Hyde suit, but become of importance in the instant case by reason of the use by the defendant of compressed air discharged into the pulp through a porous medium for both agitation and aeration, in two forms of apparatus, Callow pneumatic cells and Janney mechanical-air machines. These disclosures will now be considered.

Froth-flotation by air bubbles liberated in the pulp. One of these disclosures is of what is known as the superaeration modification, although a better name would be super-pressure-aeration. It was tersely explained by defendant's expert Dr. Byrnes in the Hyde case as follows (Vol. II, p. 891):

> "In the modified apparatus shown in Figure 2 of the drawing, the oiled and agitated pulp from the cone mixer is passed through a discharge- conduit a^1, pipe a^2, pump e and pipe e^1, into a closed chamber f, wherein it is first sub-

jected to an atmosphere of air or other gas compressed to from 50 to 100 pounds per square inch, for a few minutes, being thence discharged to the froth separator with three chambers heretofore described. The air or gas dissolved under pressure and evolved upon discharge from the compression-vessel, assisting the aeration produced in the cone agitator, is said to cause all of the oiled mineral to rise to the surface as a single froth, obviating the necessity of retreating the tailings, as with the first apparatus illustrated."

The description referred to commences at page 2, line 120, and continues to page 3, line 34, of the specification, and completely describes an operation commencing with crushed ore and ending with froth separation in a spitzkasten.

This superaeration modification is first briefly described in the specification (p. 2, lines 103-119) as an alternative method for the recovery of metal from the pulp discharged from the second and third spitzkastens of the three spitzkastens shown in Figure 1.

This part of the description is referred to by defendant's expert Dr. Sadtler, at the trial of the instant case. After referring to a feature of the Kirby patent wherein, as he says there is "a gentle agitation to loosen additional trapped mineral particles, and throw them to the top for air flotation," he adds (Vol. III, p. 1649, Q79):

> "That feature is again carried out in the patent in suit, where there is a supplemental process involving the *introduction of air without the violent agitation,* as a supplemental step in bringing more of the mineral to the surface."

Thus defendant's experts in both cases conceded, as they had to, that the specification discloses a method of introducing air without violent agitation.

In this modified procedure the air or gas super-pressure, "say fifty to one hundred pounds per square inch" (Spec., p. 3, lines 16, 17), causes air or gas to be dissolved in the pulp, and, as the specification says (p. 2, lines 111-116):

"On relief of such pressure *the bubbles of air or other gas so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth* which can be separated as before."

Again, more specifically, the specification says (p. 3, lines 17-30):

"The pressure is sufficient to cause the air or other gas to be dissolved to a considerable extent in the pulp. After the lapse of a few minutes for the due solution of the compressed air or a portion of it by the pulp or the liquid the cock g^1 is opened and the pulp is discharged into the open spitzkasten *h*, where the liquid is of course under atmospheric pressure. * * * *The whole of the mineral to which air bubbles are attached—say the oiled mineral—at once rises to the surface as a coherent scum or froth.*"

The agitation which takes place in the spitzkasten is merely the agitation from the flow of the liquid and from the liberated air bubbles. The result is a coherent mineral-carrying froth, which is "separated as before." That agitation, supplementing the agitation in the Gabbett mixer which coated the mineral particles, produces a froth of oil-coated mineral particles. The bubble-introducing effect of the Gabbett agitation undoubtedly contributes air to the bubble flotation which takes place in the spitzkasten, but the bubbles are largely dissolved by the superpressure, and new bubbles, liberated from solution when the pulp is discharged into the spitzkasten, effectuate the flotation of the mineral froth.

In connection with the first mentioned of these descriptions in the specification there is a disclaimer in the following language (Spec., p. 2, lines 116-119):

"This idea is not claimed *broadly* in this case, but forms the subject-matter of an application filed by us on January 9, 1906, Serial Number 295,326."

The idea thus disclaimed is the broad idea of air or gas bubble introduction into an ore pulp by solution of the air or

gas therein at high pressure, and liberation from solution throughout the pulp by relief from the high pressure. This broad idea is capable of use in film flotation with or without oil, and in froth flotation, with or without oil (although froth-flotation without oil, i. e., with a soluble mineral-frothing agent, was a later invention not then known), and the patent in suit is only concerned with its use in froth flotation with a mineral-froth-forming oil, which is one specific application of this broad idea. All of the uses of this broad idea are covered in the superaeration patent No. 835,479, which was issued simultaneously with the patent in suit on November 6, 1906 (Vol. III, pp. 1311-1313), on the aforesaid application filed January 9, 1906, Ser. No. 295,326 as a division of (i. e., containing matter withdrawn from or divided out of) the application for the patent in suit. The broad claim of that patent is as follows (Vol. III, p. 1313).

> "1. The process of separating powdered minerals from one another which consists in suspending the powdered minerals in a liquid, subjecting the mixture to a gas-pressure, and thereafter relieving the pressure whereby bubbles of gas are liberated in the pulp and carry certain minerals to the surface."

This is a very broad claim, and any use of superaeration in froth flotation with an oily liquid would be dominated by it. Likewise any other use of superaeration in flotation of minerals would be dominated by it. The disclosure of superaeration in the patent in suit is therefore a specific application to froth-flotation of the broad superaeration invention claimed in patent No. 835,479. To that extent the patent in suit discloses a specific application of superaeration. In fact it discloses two specific applications of superaeration, one as a supplement to the process as carried on in the apparatus shown in Figure 1 of the patent in suit, and the other either as a substitute for the continuous procedure carried on in the apparatus of Figure 1 of the patent in suit, or as a substitute for the first disclosure of carrying on the whole procedure intermittently in

the Gabbett. Both disclosures are of froth-flotation, and both are within and are covered by the claims of the patent in suit. The disclaimer of the broad superaeration invention and the reference to the companion application are therefore appropriate, properly informative to the public, and might have been necessary to prevent abandonment of the broad invention of superaeration if it had happened that the patent in suit issued first and the superaeration patent issued on a later day. It happened that the two patents issued on the same day and the information of the public was complete on that day.

Thus froth flotation with superaeration is covered by the claims of the patent in suit and is also dominated or more broadly covered by the claims of the superaeration patent No. 835,479. On the other hand froth flotation without superaeration, or any other procedure without superaeration, would not be covered by this patent No. 835,479. We have here an excellent example of the familiar fact in patent law that patented inventions may under certain conditions be used together and under other conditions may be independently used. The disclaimer in the patent in suit is therefore a proper disclaimer, exactly fitting the facts, and properly notifying the public that they are to seek in another patent the broad claims for superaeration, although its uses in the two specific applications disclosed in the patent in suit are given as examples of *modified procedures within the claims of the patent in suit.*

Obviously the purpose of the inventors in including these modified disclosures in the specification of the patent in suit was to furnish *additional examples of the application of the invention patented by the patent in suit;* and this is particularly true as to the description of the procedure in the apparatus shown in Figure 2 as a complete substitute for the entire procedures earlier described in the specification. These descriptions can have no purpose in the specifications other than to describe *modified procedures embodying the invention claimed in the patent in suit.*

Gentle agitation in coating the mineral. The other disclosure which now becomes of interest, is of a modification in the method of disseminating the oleic acid through the pulp and coating the mineral with oleic acid. The specification of the patent in suit says (Spec., p. 2, lines 9-13):

> "If desired, the oleic acid used in the first instance may be produced *in situ* in the pulp by decomposing a dilute soap solution with mineral acid, as described in the previous patent, No. 777,274, cited above."

The patent here referred to is the Cattermole, Sulman and Picard patent known as the soap and granulation patent, also referred to earlier in the specification of the patent in suit (Spec., p. 1, lines 23-27). In this patent No. 777,274 (printed Vol. III, pp. 1285, 1286), we find a full description of a procedure which obviates the necessity of employing other agitation than gentle stirring to bring the particles of oleic acid in contact with the metallic particles and to cause the metallic particles to be coated with films of oleic acid. This description is as follows (Vol. III, p. 1285, lines 32-56):

> "In carrying out our invention the suitably-crushed ore is suspended in water, and to the mixture an addition of a small quantity of soap solution is made. A small amount of mineral acid [such as sulphuric acid] is then added, which decomposes the soluble soap or other similar compound by uniting with the alkaline base thereof, thus *liberating in a state of chemical subdivision* the fatty or resin acid or other compound, such as cresol, &c., in intimate contact with the suspended ore particles. It is found that the liberated acids [*such as oleic acid,* &c.], which may even be solid under ordinary conditions, are *precipitated and adhere to the sulphuretted minerals* or to sulphur, graphite *or free metals present in the ore, leaving* the gangue or earthy particles preferentially wet by water and free from adhesions of fatty acid and the like. The fatty acid and the like used for the purpose of adhering to the mineral particles is thus produced *in situ* throughout the suspended ore mass in the most intimate contact or

admixture therewith, and the mineral particles become attached to or more or less coated by films of fatty or resin acid."

In the specification of this patent No. 777,274 there is no mention whatsoever of agitation for the purpose of coating the mineral with the oily substance. Concededly a certain amount of gentle stirring would be advisable for uniform distribution throughout the water of the "soluble soap" added in the form of "soap solution," such, for example, as is required to uniformly distribute the milk which has been added to a cup of coffee, although the distribution would be chiefly by diffusion, and similarly a gentle stirring for distributing the acid through the thin solution of soluble soap in water, but this is merely the commingling of miscible liquids. Beyond that no agitation is required for coating the mineral particles with oil.

With the employment of this suggested modification of procedure, the employment of brisk agitation for the purpose of bringing the oleic acid

> "into efficient contact with all the mineral particles in the pulp" (Spec. patent in suit, p. 1, lines 87, 88),

becomes no longer necessary and the problem of froth concentration resolves itself simply into one of producing modified air-bubbles in the pulp and bringing these air bubbles into contact with the oiled metallic particles. Obviously any apparatus that aerates effectively and brings the air bubbles into contact with the oiled metallic particles and results in the production and separation of a froth concentrate, will carry on the process. The Callow pneumatic cells which defendant uses are well adapted to perform this operation. The language of Judge Bradford in *Minerals Separation Ltd.* vs. *Miami Copper Co.* (237 Fed., 633) is here particularly apt. He considers very fully the defendant's use of a Callow cell pneumatic aerator and agitator and the disclosures of the patent in suit as to agitation in a Gabbet mixer and then says:

> "The strength of agitation referred to in the description clearly admits of different degrees, varying from one an-

other in the application of the process to different ores and under changing conditions. There is no room for doubt that agitation of the mixture in the process of the defendant is sufficiently vigorous or brisk to insure efficient ore concentration by an air flotation process such as is accomplished by the complainant by agitation under the process of the first patent in suit. This being true the use of mere adjectives in the descriptive portion of the patent with respect to agitation is unimportant. In order that the bubbles in the pulp mixture may come in contact with the metallic particles there must be such movement between them as cannot be wholly accounted for by selectivity as between them, and their movement so far as not accounted for by selectivity, is the result of agitation; and whether such agitation results from the stirring or beating of the mixture or the forcing or admission of air into it is immaterial; for what this court is dealing with is not an apparatus patent, but a process patent."

Apparatus of Figure 1. As to the continuous procedure carried on in the apparatus of Figure 1 of the patent in suit, it may be noted that the specific three-spitzkasten tailings-classifier shown and described was designed for treating the coarse crushed material which the inventors actually used, and it to some extent indicates their fear that the unusually fine crushing which they recommend in the patent might not be generally accepted by the art (Higgins, Vol. V, p. 2510, Q362). The specification says (p. 1, lines 56-61):

> "The formation of froth is assisted by the fine pulverization of the ore, and we find that slime mineral most readily generates scum and rises to the surface, while larger particles have less tendency to be included in the froth."

The specification also says (p. 2, lines 25-28):

> "The metalliferous matter which did not form part of the froth (generally the larger particles) remains in admixture with the gangue in the pulp."

The tailings-classifying function of the spitzkasten arrangement shown is well described by Mr. Higgins (Vol. V, pp. 2510,

2511, Qs360-368). The arrangement was devised for dealing with coarse crushed ores. In practice finer crushing, such as recommended in the patent, proved practicable, and first the up-currents described in the patent were discontinued (Sulman, Vol. II, p. 964, Q28) and later the apparatus was reduced to a single spitzkasten for each froth separation, as in the Minerals Separation standard machine (Vol. II, pp. 810-812). Indeed, the art is now chiefly concerned with crushing the ore to extreme fineness, 100 and 150 mesh, and the invention of the process in suit has wholly changed the procedure of the art in this respect (Higgins, Vol. V, p. 2511, Q369).

It is to be noted also that the classification (separation of different sized particles) of material treated by the process in suit, is still extensively used, as, for example, all the middlings of the Utah Arthur plant are put through a classifier to assure that only the finest particles return to treatment by the process (Janney, Vol. III, pp. 1512, 1513, Qs34, 35; Vol. IV, p. 2154, Qs31-35).

Among the recommendations of the patent in suit for further treatment to separate the metalliferous matter not recovered in the froth is *"further treatment by agitation"* (Spec., p. 2, lines 86, 87). This recommendation of the patent in suit has been followed in the development of the new art which the invention of the patent in suit created as well as the recommendation of very fine grinding, and today flotation-concentration is characterized by these two dominating factors, *fine grinding and repeated agitation and aeration.*

That an invention such as that in suit, of a new process or art, is not to be limited to the particular apparatus in which it is carried out by the inventors, is a proposition of patent law fundamental in character. The Telephone cases (126 U. S., 1, 533) illustrate the determining principles. Here Mr. Chief Justice Waite said (p. 533):

> "The patent for the art does not necessarily involve a patent for the particular means employed for using it. Indeed, the mention of any means, in the specification or

descriptive portion of the patent, is only necessary to show that the art can be used; for it is only useful arts—arts which may be used to advantage—that can be made the subject of a patent. The language of the statute is that 'any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter,' may obtain a patent therefor. Rev. Stat., Sec. 4886. Thus, an art—a process—which is useful is as much the subject of a patent, as a machine, manufacture, or composition of matter. Of this there can be no doubt, and it is abundantly supported by authority. Corning vs. Burden, 56 U. S., 15 How., 252, 267; Cochrane vs. Deener, 94 U. S., 780, 787, 788; Tilghman vs. Proctor, 102 U. S., 708, 722, 724, 725; New Process Fermentation Co. vs. Maus, 122 U. S., 413."

The specification makes the intendment of the patentees quite clear in its closing statement, as follows:

> "The nature and arrangement of the apparatus used may be varied without departing from this invention" (Spec., p. 3, lines 35-37).

Further, the specification describes Figure 1 as

> "illustrating one form of apparatus suitable for carrying this invention into practice" (Spec., p. 2, lines 47-49).

Claims Adjudged Valid by This Court.

The claims in issue are 1, 2, 3, 5, 6, 7, 9, 10, 11 and 12 as pleaded in the original bill of complaint (Vol. I, p. 3, paragraph 6) and in the supplemental bill of complaint (pp. 40, 41, paragraph 7). They are the same claims that were in issue in the Hyde case, the charge of infringement in that case having been thus limited by notice on the record (Vol. I, p. 190). The only change that has occurred in these claims has been the limitation of claims 9, 10 and 11 by disclaimer, to be hereinafter considered. The claims in issue are analytically stated by Professor Chandler (Vol. I, pp. 178-180), and reference to his analysis may be useful for comparison.

Claim 1 is as follows:

"1. The herein-described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), agitating the mixture until the oil-coated mineral ~~water~~ matter forms into a froth, and separating the froth from the remainder by flotation."

According to the process pointed out in this claim powdered ore and water are commingled to form an ore pulp, a small proportion of an oily liquid having a preferential affinity for metalliferous matter, amounting to a fraction of one per cent. on the ore, is added to the pulp, and the mixture is agitated until the oil-coated metalliferous particles form into a froth, and this froth is separated from the remainder by flotation. If, with the oily liquid used, the agitation does not produce a froth of oil-coated metalliferous particles, the process cannot be carried on. Therefore only those oily liquids are included in the claim which possess the mineral-froth-producing quality, and an oily liquid which lacks this quality cannot be an oily liquid of this claim.

The words "an oily liquid having a preferential affinity for metalliferous matter" include oleic acid, which is not chemically an oil, and include all oils, but if the claim had been for oils alone these qualifying words would have been unnecessary and would not have been used, as they are not used in the "oil" claims (claims 9, 10, 11 and 12). But although these words, taken alone, include all oily liquids having a preferential affinity for metalliferous matter and thereby necessarily include all oils, they must be read in connection with the other limiting words of the claim, and unless the oily liquid or oil will effectuate the process described in the claims and form "into a froth" of "oil-coated mineral matter" upon "agitating the mixture" it cannot be the oily liquid or oil of the claim.

This process, as disclosed in the patent, may be carried on intermittently, as first disclosed in the patent, in a single Gabbett mixer, by adding the charge, briskly agitating it, stopping the agitation to allow the liquid to come to rest and

the air bubbles and attached mineral particles to rise to and through the surface of the liquid and to form a froth floating thereon, and removing the froth by skimming, draining, or overflowing; or by flowing the agitated pulp into a spitzkasten without stopping the agitation, and allowing the froth to rise in the spitzkasten, or otherwise. It may be carried on continuously, as disclosed in the patent, by continuously feeding the ore pulp and oil to an agitating vessel or a series of agitating vessels, continuously flowing out the contents into a separating vessel or spitzkasten or series thereof, continuously overflowing the froth therefrom and continuously flowing out the residue or tailings from the bottom of the separating vessel or spitzkasten, with classification of these tailings in successive spitzkastens if desired. Also, as disclosed in the patent, air bubbles may be liberated in the pulp to attach themselves to the oiled metallic particles and sweep them to the surface to form the froth, as by superaeration. Also, as disclosed in the patent, any oily liquid may be liberated *in situ* completely disseminated throughout the ore pulp, by introduction in the form of soluble soap and precipitation by mineral acid, obviating the necessity of other than the most gentle agitation for the purpose of disseminating the oily liquid through the pulp. *The breadth of the disclosure is commensurate with the breadth of the claim.*

In the Hyde case the defendant copied the exact methods of the plaintiffs and there was no occasion to consider the superaeration and soluble soap modifications. In the Miami case the defendant used Callow cells, with air forced through porous false bottoms and wherein there was agitation by aeration, as the froth-separating vessels, and also used preliminary agitators which both agitated and aerated the pulp. In the instant case the defendant added porous bottoms, for air agitation, to the spitzkastens of the last four of each set of seven successive so-called pyramid mechanical agitation machines (Janney machines), and added Callow pneumatic cells (called air cells) for the final removal, by air-froth flotation, of the metallic par-

ticles in the depleted pulp (i. e. tailings) discharged from these pyramid machines (*infra*, p. 100).

In the Hyde case and in the Miami case the defendants used the proportions of oil specified in this claim. In the instant case the defendant did so from 1911 until the end of 1916. Since then it has at times managed to increase the total amount of oils used to something a little larger than a fraction of one per cent. of oil on the ore, but has not succeeded in increasing the mineral-froth-producing oil to anything more than critical proportions amounting to a small fraction of one per cent. It has therefore always infringed this claim.

Claim 2 differs from claim 1 in that it adds to what is pointed out in claim 1 that the water shall be "slightly acidified," and the defendant here has always slightly acidified his pulp.

Claim 3 adds to what is pointed out in claim 2 that the mixture shall be warmed. It therefore specifies both acidification and heating. The defendant has used both until recently.

Claim 4 is not in issue.

Claim 5 is as follows:

> "5. The herein-described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of oleic acid amounting to 0.02-0.5 per cent. on the ore, agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith, and separating the froth from the remainder by flotation."

This claim differs from claim 1 in that the oily liquid is stated to be oleic acid in the proportion of 0.02% to 0.5% on the ore. This claim was only infringed by those procedures of the defendant wherein oleic acid was used, terminating in 1914. It is an oleic acid claim and therefore its upper limit of 0.5% on the ore is a limitation restricted in its application to a process employing oleic acid as the oily liquid. This limitation, to an upper limit of one-half of one per cent. on the ore, is imposed by the Circuit Court of Appeals upon all of the claims in issue.

The expression "having a preferential affinity for metalliferous matter" which appears in claims 1, 2 and 3, does not appear in claim 5 or in any of the succeeding claims. Oleic acid has this quality; so also have oils. But the description of the operation essential to the process of every claim, to wit: mineral-froth formation, appears in this as it does in every claim (in claims 9, 10 and 11 by disclaimer). Moreover as this claim is specific to oleic acid, a viscous oily liquid, the agitation here described is such as will bring the oleic acid into efficient contact with the mineral, as well as form a froth with the mineral. The descriptive language used is as follows:

> "agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith."

This is the most specific description of agitation which appears in any of the claims, and this description is exactly repeated in the other two of the three "oleic acid" claims (claims 5, 6 and 7). This claim was infringed up to the end of 1914.

Claims 6 differs from claim 2 in the same respect as claim 5 differs from claim 1, i. e., it adds acidification to all that is included in claim 5, by specifying "water containing a fraction of one per cent. of sulphuric acid." It was infringed up to the end of 1914.

Claim 7 differs from claim 3 in the same respects as claim 5, and adds to claim 6 the statement that the warming shall be to 30° to 40° Centigrade (86° to 104° Fahrenheit), i. e., it adds acidification and heating of a specific character to what is included in claim 5. This also is an oleic acid claim and was infringed up to the end of 1914.

Claim 8 is not in issue.

Claims 9, 10 *and* 11 have been limited by the disclaimer and will be separately considered.

Claim 12 is as follows:

> "12. The process of concentrating powdered ore which consists in separating the minerals from gangue by coating

the minerals with oil in water containing a fraction of one per cent. of oil on the ore, agitating the mixture to cause the oil-coated mineral to form a froth, and separating the froth from the remainder of the mixture."

This claim is the broadest claim wherein it is specifically stated that the oil is a fraction of one per cent. on the ore. The agitation described in this claim is stated to be for the purpose of causing "the oil-coated mineral to form a froth" and the *method of "coating the minerals with oil" is not specified.* If, for example, according to the specification, diluted soft soap solution were used as the pulp liquor and oleic acid were precipitated by sulphuric acid from the pulp liquor and thereby the minerals were coated with oleic acid, with only gentle stirring, the language of this claim would directly apply, even should it be held that the language of claim 1 did not apply (it being noted that oleic acid in the process is the equivalent of an oil, as this Court has decided). Again, if it were possible to coat the minerals with oil by any other preparatory treatment which did not involve aeration of the pulp, as, for example, by an agitation in a vacuum, or an agitation that did not introduce air into the pulp, the exact terms of claim 12 would be satisfied, for the claim is not limited to any method of coating the minerals with oil.

This claim has at all times been infringed by the defendant.

Disclaimer.

The Disclaimer was timely filed. The disclaimer was filed in the United States Patent Office on March 28, 1917. The opinion of this Court was filed December 11, 1916. The Mandate was issued January 13, 1917. The disclaimer was filed many months before the expiration of the period allowed by the rules of this Court for petitions for rehearing by the respective parties.

Judge Bourquin held that "it was timely filed" (Vol. I, p. 99) as also did Judge Morrow (Vol. VI, p. 3111; Appendix to

Petition, p. 41) and Judges Ross and Hunt so held *sub silentio.*

In the oral argument before the Circuit Court of Appeals Frederick P. Fish, Esq., of counsel for defendant, well stated the situation as to reasonable time for filing the disclaimer, his language being here given as uttered and as reported by the court stenographer:

> "I do not myself think there can be any argument on something that was argued in the court below, that one hundred and seven days elapsed after the Supreme Court decision before the paper was filed—that that was lack of diligence. It does not seem to me worth while to argue that question, because it takes time to think these things over."

The Disclaimer was duly executed and filed. The disclaimer was executed by Minerals Sparation Ltd., one of the petitioners herein, assignee of record of the patent in suit (see recorded assignment Vol. II, pp. 569, 570) and sole owner of the legal title, by John Ballot, its attorney in fact (Vol. I, p. 61) and defendant's answer to the supplemental bill of complaint admits that it was filed in the Patent Office by Minerals Separation, Ltd. (pp. 64, 65, paragraph V). It was offered in evidence at the opening of the trial, on April 16, 1917 (Vol. III, p. 1343) and was only objected to upon the grounds that it should have been filed immediately upon the rendition of the decision of this Court in the Hyde case, and that it disclaimed nothing (*ib.*). These objections were fully argued (pp. 1343-1368) and the document was admitted in evidence by Judge Bourquin after full opinion from the Bench as to the timeliness of the disclaimer and its effectiveness in validating claims 9, 10 and 11 (pp. 1368-1370). This early judicial sanction was repeated in Judge Bourquin's opinion filed after the trial (Vol. I, p. 99).

The Disclaimer cured the invalidity found by this Court. This Court found the patent invalid as to claims 9, 10 and 11, and valid as to all the other claims for the reason that (242 U. S., 271)

> "the patent must be confined to the *results obtained by the use of oil* within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' *'amounting to a fraction of 1 per cent. on the ore,'* " etc.

The disclaimer refers to the decision of this Court and repeats the language of the decision of this Court. In it petitioner (Vol. I, p. 61)

> "does hereby disclaim from claims 9, 10 and 11 of said letters patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are *the results obtained by the use of oil* in a quantity *amounting to a fraction of one per cent. on the ore.*"

The repeated words are italicised in the two above quotations.

This disclaimer, in purpose and in terms, cut off, and excluded, from the subject-matter of claims 9, 10 and 11, all the excess, whatever it might be, that was included within those claims over and above what this Court had said the patent must be confined to; and in legal effect, therefore, it confined claims 9, 10 and 11 to the subject-matter to which this Court had said the patent must be confined.

On its face the disclaimer refers to this Court's decision in the Hyde case as advising Minerals Separation, Ltd., of the infirmity of the patent, in so far as concerns claims 9, 10 and 11, and so it must be interpreted in the light of that decision. And in its disclaiming part it employs the very words of the decision.

Whatever the overplus found by this Court to be within the inclusion of claims 9, 10 and 11 was, that overplus is disclaimed by the disclaimer, and the disclaimer therefore leaves claims 9, 10 and 11 "confined" (as claims 1, 2, 3, 5, 6, 7 and 12 of the patent were found to be already "confined" without any disclaimer),

> "to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of 1 per cent. on the ore.' "

Petitioners in their supplemental and amended bill of complaint filed May 1, 1917 (Vol. I, p. 38), pleaded the filing of the disclaimer (p. 40, par. 5), the consequent validity of claims 9, 10 and 11 as limited by that disclaimer, and that the defendant had infringed these claims as thus limited since the issuance of the patent in suit and prior to the filing of bill of complaint and that it continued so to do (par. 7).

Defendant filed an answer to the supplemental bill of complaint on May 4, 1917 (Vol. I, p. 63) in which, and especially in paragraphs V (p. 64) and X (pp. 66, 67), it pleaded that the disclaimer was in effect and in law no disclaimer at all, and in any event that it had been filed too late, that is to say, not without unreasonable neglect and delay, and that the patent in suit is in consequence invalid and void not only as to claims 9, 10 and 11 but also as to claims 1, 2, 3, 5, 6, 7 and 12, and all other claims.

The disclaimer is quite fully discussed in the Brief for Petitioners (pp. 90-93) to which reference is here made.

The disclaimer accords with the statutes. The statutes in question are Sections 4917 and 4922 U. S. R. S. Those statutes prescribe that whenever without fraud a patentee has *claimed* more than that of which he was the original and first inventor or discoverer, his patent will be valid (Section 4917), and he may maintain an infringement suit at law or in equity (Section 4922), as to any or all of that part which is truly and justly his own, if it is a material and substantial part of the thing patented and definitely distinguishable from the parts claimed without right, provided such patentee, his executors, administrators, heirs or assigns make disclaimer without unreasonable neglect or delay of such parts of the thing patented as he shall not choose to claim or hold by virtue of the patent.

In the case at bar no fraud in originally making claims 9, 10 and 11 is alleged or proved. This Court in the Hyde case held that in and by claims 9, 10 and 11 the patentees had claimed more than that of which they were the original and first inventors or discoverers. This Court at the same time held that the patentees had made an invention of importance, and defined it,

and by necessary implication held that that invention was definitely distinguishable from the parts claimed in claims 9, 10 and 11 without right.

Claims 9, 10 and 11 were held invalid because broader in scope than the actual invention. They covered and included the process that constitutes the actual invention, but they also covered and included processes that were not the actual invention. The disclaimer disclaims that overplus, that excess over and above the real invention, and disclaims the whole of that overplus or excess. The disclaimer prunes down the claims to a scope no broader than the real invention. Claims 9, 10 and 11, without the disclaimer, would have been infringed by one who made use of the real invention. They would also, as this Court construed them, have been infringed by one who employed other and different processes. Claims 9, 10 and 11 as limited by the disclaimer would be infringed by one who used the real invention, but they would not be infringed otherwise. The disclaimer has therefore cured those claims of the patent from the vice of claiming more than that of which the patentees were the original and first inventors or discoverers.

Nothing has been added by the disclaimer to the description or to the claims or to the breadth or scope of the claims. As to the description nothing has been changed or altered. As to the claims (9, 10 and 11) they have merely been narrowed in scope to eliminate from them, and with the legal effect of eliminating from them, the extra breadth or scope or overplus of scope that caused this Court to hold them invalid.

This limitation of the scope of a claim by cutting off so much of its inclusion as extends it out beyond the confines of the real invention is the very purpose and idea of a disclaimer under the law and the practice.

Claims 9, 10 and 11 were held invalid by this Court, not because they would not be infringed by the practice of the real invention of the patentees, but because they might also be infringed by the practice of processes and procedures that would not embody the real invention in that those processes obtained results different from those obtained by the use of oil in

a quantity amounting to a fraction of one per cent. on the ore. Those claims since the date of filing of the disclaimer do not cover or include any processes or procedures except one within their terms where the results obtained are those obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore.

Thus claim 9, since the entering of the disclaimer, is, in contemplation of law, only for the process of concentrating powdered ores, which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth, where the results obtained are those obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore.

Similarly claim 10 is for that process where the mixture is warmed; and claim 11 is for that process when there is added a quantity of acid insufficient to cause chemical action on the metalliferous minerals present.

Illustrations of similar disclaimers upheld as valid and effectual under the law are numerous. In *Carnegie Steel Co.* vs. *Cambria Co.*, 185 U. S., 403, 435:

> "the disclaimer was not of a claim but of certain statements in the specification, which if retained, might be construed to have the effect of illegally broadening the second claim."

In that case, apparently, the claim was susceptible either of an illegally broad or of a legally narrow construction, and the court allowed as a proper and valid disclaimer the disclaimer of certain statements in the specification that might have imported an illegal breadth into the claim. All the more clearly within the statute is the case at bar, where the illegal broadening of the claim is found not in any statement of the specification but in the language of the claim itself. If a disclaimer of any illegal broadening of a claim implied from a statement in the specification is within the statute, much more is a disclaimer of an illegal broadening of a claim expressed on its

face, for the latter is what the statutes expressly and explicitly address themselves to.

In the case under citation this Court said:

> "As we had occasion to observe in *Sessions* vs. *Romadka*, 145 U. S., 29, 'the power to disclaim is a beneficial one, and not to be denied except where it is resorted to for a fraudulent and deceptive purpose.' "

Citing *Hurlburt* vs. *Schillinger*, 130 U. S., 456; *Schillinger* vs. *Gunther*, 17 Blatch., Fed. Cases No. 12458; *Schwartzwalder* vs. *N. Y. Filter Co.*, 66 Fed., 152.

In *Silsby* vs. *Foote*, 14 Howard, 218, 221, the claim was for the application of a certain automatic damper control for a stove "or other structure." It was shown that the same automatic control was old to regulate the heat of other structures than a stove. Thereupon the patentee entered a disclaimer (p. 220):

> "to so much of said claim as extends the application of the the expansive and contracting power of a metallic rod, by different degrees of heat, to any other use or purpose than that of regulating the heat of a stove, in which such rod shall be acted upon directly by the heat of the stove or the fire which it contains."

This Court sustained the disclaimer.

In *Tuck* vs. *Bramhill*, 24 Fed. Cas., 259 (6 Blatch., 95), the claim was for a packing for pistons of a certain construction, "with or without a core." After testimony had been taken showing the structure old without the core, plaintiff filed a disclaimer "to that part of the claim which covers the packing therein described without a core," thereby limiting the claim to the peculiar packing recited when employed with a core, and the validity of that disclaimer was at issue. The Court said (p. 262):

> "It having been shown that the forming of the roll in the manner described, without the core, was old, the next

question is, whether the plaintiff could disclaim, as he has attempted to do, the forming of the roll without the core, and limit his claim to the forming of the roll with the core."

The Court upheld the disclaimer as valid.

In *Electrical Accumulator Co.* vs. *Julien Co.*, 38 Fed., 117, the claim was for an electrode of a secondary battery coated with a certain active layer by galvanic action or chemical precipitation or otherwise. The specification had described the application of the active layer mechanically in the form of a paint, paste or cement, and also its application by galvanic deposition, and also its application by chemical precipitation. The Court found that the real invention was the application of the active material mechanically in the form of a paint, paste or cement. The Court found that it was old to apply the active material mechanically in the form of a dry powder. The Court suggested that the claim might be limited by disclaimer to the real invention, and plaintiff subsequently filed a disclaimer of any and every way of coating an electrode with an active layer in which the active layer was wholly applied otherwise than in the form of a paint, paste or cement practically insoluble in the electrolytic liquid, and the disclaimer was upheld as valid. Incidentally the disclaimer cut out certain phrases from the specification descriptive of other ways of coating an electrode than by mechanically applying in the form of a paint, paste or cement.

In *Thompson* vs. *Bushnell*, 96 Fed., 238, a patent was involved which had been held invalid or not infringed in *Thompson* vs. *Jennings* (66 Fed., 57; on appeal, 75 Fed., 572), where the Circuit Court of Appeals had intimated that the patent could be sustained only if limited to hack saws and band saws. On this suggestion the owners of the patent filed a disclaimer in the Patent Office "of so much of said claims as covers circular saws and back saws, leaving said claims to include only "hack saws and band saws." The Circuit Court of Appeals sustained this disclaimer. The Court said (p. 242):

> "The phraseology of the claims, however, read in connection with the specification, was broad enough to cover all four varieties of the class known as 'metal saws,' although as to two of them it was useful, and as to the other two useless. Certainly there was an actual, separable invention, and a specification and claim broader than the invention. In view of the fact that the four varieties of this class of saw were well known to the art and their differences clearly recognized, as the evidence shows, no amended specification or supplemental description is required to make the new claim intelligible, and a disclaimer of circular and back saws leaves the patent in force as to the other varieties of the class."

The defendant argued that the disclaimer was not a proper one, the theory being that there was no separate invention in its application to different kinds of saws, and that a restriction of the claim to any one kind of saw was practically adding to the claim a new element, to wit: the kind of mounting, different kinds of saws being distinguished from each other only by their particular kind of mounting. But the Court held to the contrary.

In *Schwartzwalder* vs. *N. Y. Filter Co.*, 66 Fed., 152, a disclaimer was upheld which struck out from the specification certain broadening language which made the claim by construction too broad, in view of the state of the art. In that case the disclaimer was of a recital in the specification that had been intended to enlarge the scope of the claim. The Court said (p. 158):

> "The disclaimer consequently operates only to expunge from the claim what otherwise would, by force of the recital, be incorporated into it constructively. * * * The patent after the disclaimer, is to be read exactly as though the recital had never been inserted."

It was urged by the defendant that the defense of want of novelty should be tested by the original terms and scope of the claim, but the Court said (pp. 157, 158):

"We are aware of no principle which will permit a patent to be defeated for want of novelty in respect to the subject-matter which has been eliminated from it by a disclaimer. The office of a disclaimer is to enable the patentee to save himself from the peril of such a defense. Matters which have been properly disclaimed cease to be a part of the invention, and, as was said by the Supreme Court in *Dunbar* vs. *Myers*, 94 U. S., 194: 'It follows that the construction of the patent must be the same as it would be if such matters had never been included in the description of the invention or the claims of the specification.'"

In *Simplex Co.* vs. *Pressed Steel Car Co.*, 189 Fed., 70, the Circuit Court of Appeals for the Second District sustained a disclaimer to a part of the specification which said

"that, though the best results are obtained by keeping the tension member straight, if the construction be varied by bending the tension member and keeping the compression member straight it will still be within the spirit of the invention."

The effect of the disclaimer was held to be to limit the patent to a bolster having a straight tension member and a compression member with its end bent. The Court said:

"The effect of the disclaimer was not to broaden the claim, but to limit it to the construction described and shown, of a straight tension member and a bent compression member. Until this disclaimer was allowed it was possible to contend for a construction of claim 6 broad enough to include a structure described in the language disclaimed, viz., a straight compression member and a bent tension member. That this was a proper case for a disclaimer and that the language disclaimed is no longer a part of the specification, are propositions which are sustained by the following authorities: *Dunbar* vs. *Myers*, 94 U. S., 187; 24 L. Ed. 34, and cases cited in *Accumulator Co.* vs. *Julien Co.* (C. C.), 38 Fed., 117, 133-136."

In *Libby* vs. *Mt. Washington Glass Co.*, 26 Fed., 757, Judge Colt said (p. 759):

"The claims of the patent are as broad as the specification, and are not limited to any particular compound. Since bringing suit, the plaintiff has filed a disclaimer under the statute, in which he limits his claim to the gold-ruby compound. This the plaintiff had a right to do. Under the authorities cited by the plaintiff, this was a patent where a part could be properly disclaimed. It did not require the importation of anything new into the specification, but simply the elimination of a part of what was originally claimed. A disclaimer can be made after suit is commenced."

In *Marconi Wireless* vs. *De Forest,* 243 Fed., 560, the Circuit Court of Appeals for the Second Circuit sustained a disclaimer similar to that in the case at bar. In that case the claims in suit were as follows:

"1. The combination of a vacuous vessel, two conductors adjacent to, but not touching, each other in the vessel, means for heating one of the conductors, and a circuit outside the vessel connecting the two conductors."

"37. At a receiving station in a system of wireless telegraphy employing electrical oscillations of high frequency, a detector comprising a vacuous vessel, two conductors adjacent to, but not touching, each other in the vessel, means for heating one of the conductors, a circuit outside of the vessel connecting the two conductors, means for detecting a continuous current in the circuit, and means for impressing upon the circuit the received oscillations."

After action began, plaintiff entered a disclaimer "to the combination of elements set forth in claim 1, * * * except as the same are used in connection with high-frequency alternating electric currents or electric oscillations of the order employed in Hertzian wave transmission," and also to certain words of the specification referring to low-frequency currents. The Court said (p. 565):

"The contention that Fleming's patent, whatever its original merit or lack thereof, was voided by an unlawful

disclaimer, is without substance. The mistake (if there was one) was in claiming something not needed, and the disclaimer abandoned what was not wanted, without broadening or enlarging any claim; it also left the claims fully supported by the original specification. No injury to defendant, or any one else, is shown. The procedure is within *Carnegie Steel Co.* vs. *Cambria Iron Co.*, 185 U. S., 403; 22 Sup. Ct., 698; 46 L. Ed., 968, and our former decisions in *Simplex, etc. Co.* vs. *Pressed Steel Co.*, 189 Fed., 70; 110 C. C. A., 634, and *Strause, etc., Co.* vs. *Crane Co.*, 235 Fed., at page 129; 148 C. C. A., 620."

In *Page* vs. *Dow*, 200 Fed., 72, Judge Hazel sustained as valid a disclaimer which practically changed the words "constantly acting source of power" in a combination claim into the words "constantly rotating drive shaft."

The Court said (page 73):

> "The defendant insists that the disclaimer changes the character of the invention and substitutes a different element; but I am persuaded by the proofs to the contrary. To substitute the words 'constantly rotating drive shaft' for the words 'constantly acting source of power' did not, in my opinion, alter or change the invention; nor was it the addition of an equivalent element for one that had been abandoned. The effect of the disclaimer was merely to limit the original claim, which was thought too broad, to a constantly rotating drive shaft actuated by a constantly rotating motor. Disclaimers of this description, when filed within a reasonable time of the discovery that a disclaimer is necessary, have many times received the approval of the federal courts." See authorities cited.

For a most excellent discussion of the whole law of disclaimer see *Suddard* vs. *American Motor Car Co.*, 163 Fed., 852.

Under these and other similar authorities that might be cited, it appears that in the case of a claim that is too broad, broader than the real invention, or that is ambiguous and so may be construed more broadly than the real invention, the patentee may disclaim the excess over and above what he has

invented and make his patent in that way, and to that extent, specific and definite and free from ambiguity.

There is nothing in the authorities or in the Statute, or in reason, that would require the patentee to give up and disclaim the whole of claims 9, 10 and 11, for that would be to disclaim the part which he has invented and to which he is justly entitled, as well as the excess over and above that part. By disclaiming the excess he retains only that part to which he is entitled. There is nothing in the law which would require him to give up the portion of these claims to which he is entitled. The law does not require that an entire claim be disclaimed, but only the excess over and above what has been invented.

The statutes provide a remedy by re-issue (Section 4916) whenever a patent is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new. The remedy by disclaimer applies also to a case where the patent is invalid by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new. The remedy by disclaimer is proper where the part that is left was truly and justly the patentee's invention and was a material and substantial part of the thing patented and is definitely distinguishable from the parts claimed without right. In such a case the remedy apparently might be either by disclaimer or by re-issue. Where, however, there is any change or alteration *in the specification* (other than mere excision of specific statement) the remedy cannot be disclaimer and must be by re-issue. In other words, if the specification is defective or insufficient in any respect the remedy must be by re-issue. For example, if the claim is narrower than the real invention, the patent is regarded as inoperative and the specification as defective or insufficient for the purpose of covering the real invention, and in such case the only remedy is by re-issue. This broadening of the claim out to the limits of the real invention has been the usual purpose of re-issuing and such re-issues have been upheld where they have not changed or altered the invention and have been

promptly applied for. A re-issue to narrow the scope of a claim is unusual except where some change has coincidently to be made in the specification or new claims are to be added. Where nothing but diminution of claim is sought and the part left is definitely distinguishable from the part claimed without right, there the remedy by disclaimer is appropriate and effectual. This matter is discussed in many of the cases cited and in others. See *Carnegie Steel Co.* vs. *Cambria Co.*, 185 U. S., 403. In that case this Court through Mr. Justice Brown said (p. 436):

> "Had the purpose of the disclaimer been to reform or alter the description of the invention, or convert the claim from one thing into something else, it might have been objectionable, as patents can only be amended for mistakes of this kind by reissue. But the disclaimer in this case appears to have been made to obviate an ambiguity in the specification, and with no idea of obtaining the benefit of a reissue. If the [disclaimed] clauses had the effect of broadening the patent the disclaimer removes the objection. If they did not, the disclaimer could do no harm, and cannot be made the subject of criticism."

In the instant case the disclaimer has no purpose or effect to reform or alter the description of the invention, or to convert the claim from one thing into something else. But it has been made to remove from the scope and purview of claims 9, 10 and 11 all that part which in the judgment of this Court was claimed there without right, and so to obviate the objection to the patent that it claimed more than the patentee had the right to claim as new.

Claims Validated by Disclaimer.

Claim 9 as it appears in the patent, with the addition thereto of the exact limiting words of the disclaimer, is as follows:

> "9. The process of concentrating powdered ores which consists in separating the mineral from the gangue by

> coating the mineral with oil in water containing a *small quantity of oil*, agitating the mixture to form *a froth*, and separating the froth,"

when the process is one wherein

> "the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

Briefly, the limiting words of the disclaimer limit *"small quantity"* to such "small quantity" as will in each instance, with the particular ore and mineral-froth-forming oil used, produce the new results first obtained by the patentees. These will be "critical proportions" and so far as experience has taught up to the present time, "a fraction of one per cent. on the ore." If this Court intended to confine the patent to the use of oil in a quantity not exceeding a fraction of one per cent. on the ore, as the identifying means of the process, then the claim is so confined. If this Court so intended, then that is the meaning of the words "results obtained by the use of," etc. —the language of this Court repeated in the disclaimer—and the "small quantity" must be a fraction of one per cent. on the ore. So also the disclaimer limits *"a froth"* to a froth of oil-coated mineral matter.

The claim as thus confined is clearly one which takes account only of mineral-froth-forming oil. An oil which would not, upon "agitating the mixture" "form a froth" of oil-coated mineral matter, would not obtain the results prescribed, and is certainly not an oil of this claim.

All courts and judges by whom the validity of the disclaimer has been considered have found it valid and effective,* but by reason of their variant interpretation of the opinion of this Court they have variantly construed claims 9, 10 and 11 as limited and validated by disclaimer. These variant constructions will now be briefly summarized as follows:

*Judge Bourquin, explicitly (Vol. I, p. 99); Judge Morrow, explicitly (Vol. VI, p. 3111; Appendix to Petition, pp. 40, 41), and Judges Ross and Hunt *sub silentio*, in decreeing validity (Order Modifying Decree, Vol. VI, p. 3113; Appendix to Petition, p. 43; see Brief for Petitioners, pp. 93-95.

(1) Judges Ross and Hunt construe these claims as limited to the *use* of *any oil*, whether it effectuates the process or not, *in such fraction* of one per cent. on the *ore as shall not exceed one-half of one per cent.*

(2) Judge Morrow construes these claims as limited to the *use* of *any oil*, whether it effectuates the process or not, *in any fraction of one per cent. on the ore.*

(3) Judge Bourquin construes these claims as limited to the *beneficial use* of oil and therefore only the use of an oil that will effectuate the process, *in any fraction of one per cent. on the ore.*

Petitioners attach significance to the words *"results obtained"* in the opinion of this Court, and believe they were intended as identifying means of the process to which the patent was confined (and the results obtained are an absolute and infallible identifying means of the process); but whatever they mean in the opinion of this Court they also mean in the disclaimer.

Another characteristic of claim 9, and also of claims 10 and 11 is that it prescribes first "coating the mineral with oil in water," without limitation to the method whereby that oil-coating operation is effected, and thereafter "agitating the mixture to form a froth." In this respect this group of claims resembles claim 12, and has the same breadth as including any method of oil-coating or oiling the mineral (*supra*, p. 47).

The difference between claims 9, 10 and 11 and all of the other claims in issue, that they only describe "a froth" and not a froth of "oil-coated mineral," as do claims 1, 2, 3 and 12, or of "oleic acid" and "mineral," as do claims 5, 6 and 7, has been cured, as above noted by the disclaimer.

Claims 9, 10 and 11 also are different in language from claim 12, in that their closing words are "separating the froth," whereas claim 12 says "separating the froth from the remainder of the mixture" and the other claims say "separating the froth from the remainder by flotation." No defendant has yet devised a procedure wherein concentration is effected by the

process in suit, and the mineral-froth is separated otherwise than by flotation, but this breadth of language in claims 9, 10 and 11 may be useful in the future, and this Court has already said, in describing the patented process (242 U. S., 265):

> "This froth can be removed and the metal recovered by processes with which the patent is not concerned."

There can be no doubt that defendant has infringed claim 9 in all of its operations from August, 1911, until the present time.

Claim 10 adds to claim 9 the words "warming the mixture," i. e., warming the pulp. This covers everything that the defendant has done up to the end of 1916 and at times thereafter.

Claim 11 adds to claim 9 the words "and a quantity of acid insufficient to cause chemical action on the metalliferous minerals present," i e., it adds acidification to claim 9 (but not heating) with the qualification that the quantity of acid used shall not be sufficient to cause chemical action on the metalliferous minerals of the ore. This does not exclude chemical action on the gangue constituents of the ore, such as calcite, but only such decomposition of the metalliferous minerals, the sulphides of the values, and we may add substantial and not negligible decomposition thereof. All of ~~appellant's~~ procedures have employed acid in such manner as to be within the language and scope of this claim.

Commercial Use of the Invention.

Australia. In the Hyde case the evidence describes the rapidity with which the process was put to work on the dumps (some ten or twelve million tons of residues of former operations) and at the mines, at Broken Hill, Australia, with very great profit and advantage, some 10,000,000 tons of material having been treated up to June 30, 1912, with profits in the neighborhood of $5,000,000. It is of interest that in Australia the so-called beater form of agitator was first applied

(Chapman, Vol: 1, p. 228, Q27), which is now standard in petitioners' machines, and which Hyde copied. This beater agitator replaced the revolving cone or Gabbett agitator which was first used (Q26).

The frothing agents used in Australia were first oleic acid, at two pounds to the long ton of ore (Chapman, Vol. 1, p. 228, Q25), then at one and one-half pounds to the long ton (p. 230, Q35, p. 242, Qs92, 93), and finally "eucalyptus oil and oleic acid in the total proportion of 0.9 to 1.3 lbs." per long ton of ore (Wincey, Vol. I, pp. 351, 352, Q21) being 0.04% to 0.06% on the ore.

Russia. The installation at Orijarvi, Finland, Russia, is described in the Hyde case. The frothing agent was a mixture of oleic acid at 0.5 to 2 pounds to the long ton of ore and eucalyptus oil at 0.2 pounds to such ton (Chapman, Vol. I, pp. 243, 244, Q102) being 0.02% to 0.09% oleic acid and 0.009% eucalyptus oil on the ore.

Sweden. The installation at the Saxbergets mine, Rafola, Sweden, is described in the Hyde case. The frothing agent used was wood tar oil at four pounds to the long ton of ore (Chapman, Vol. I, p. 244, Q104), being 0.18% on the ore. Wood tar oil contains both oily and soluble frothing agents (Higgins, Vol. V, p. 2608, Q9).

Wales. The operations at Swansea, South Wales, Great Britain, are described in the Hyde case. The standard frothing agent was oleic acid at two pounds to the long ton of ore (Chapman, Vol. I, p. 243, Qs96, 97), being 0.09% on the ore.

South America. The Braden mine installation in Chili, South America, was in course of erection when testimony was taken in the Hyde case. Mr. Chapman testified as to the preliminary tests which determined that four pounds of oil to the long ton of ore (0.18%), composed of three pounds (0.135%) of Texas fuel oil and one pound (0.045%) of wood tar oil, would effectively concentrate the ore when crushed to 80 mesh (Vol. I, p. 245, Q112). This is the earliest adoption of a non-froth-forming oil in connection with the process in suit. Texas fuel oil, in minute amount, in conjunction with the process in

suit and the process of the solution patent (see Brief for Petitioners, pp. 11-13), acts to prevent coarser metallic particles from falling out of the froth, with resultant economy in the cost of grinding the ore (Higgins, Vol. V, p. 2612, Qs41, 42). Wood tar oil contains both oily and soluble frothing agents (Higgins, Vol. V, p. 2608, Q9).

At the trial of the instant case Mr. Chapman testified to a visit to this plant in 1913 (Vol. V, p. 2289, Q4), that he found installed there seven 600-ton per day standard Minerals Separation flotation machines (capacity 4200 tons per day), not giving good results because of bad milling conditions (Q5), the feed being irregular and the material delivered to flotation being too coarse (pp. 2296, 2297, XQs80-82). These conditions were corrected (p. 2289, Q5). The capacity of this plant is about 1,500,000 tons of material treated per year.

Cuba. The plant of the Cuba Copper Company was referred to in the Hyde case as then in course of erection. In the instant case Mr. Chapman testifies to visiting it in 1913 (Vol. V, p. 2289, Q4) and finding it at work on 500 tons per day of copper ore (Q8), or more than 150,000 tons per year.

Canada. The Canadian licensees are included in the list of American licensees (Ballot, Vol. V, pp. 2256, 2257, Qs1, 2) and not particularly identified, but evidence was given at the trial of the work under the process in suit of Britannia Mining & Smelting Company (now Howe Sound Company) commencing in June, 1912 (Greninger, p. 2264, Qs9, 10) starting with a 50-ton per day plant (Q13), and that in July, 1913, the plant had been increased to 600 tons per day (p. 2265, Qs21, 22), and the mill had been reorganized to eliminate hand sorting, and the water concentration elements of coarse jigs, tables and vanners (Qs25, 26). The frothing agent used was wood tar oil (containing both oily and soluble frothing agents) (Higgins, Vol. V, p. 2612, Qs41, 42) mixed with certain mineral oils (p. 2264, Q14), at about two pounds of the mixture to the ton of ore (Q17), the mixture being 25% wood tar oil, 25% petroleum distillate and 50% fuel oil (p. 2272, XQs119-123). This is, like the procedure at the Braden mines in Chili, an example

of the use of fuel oil in minute amounts, one-half a pound to the ton of ore (0.025% on the ore) to prevent coarser mineral from falling out of a froth produced by the conjoint use of the process in suit and the process of the solution patent No. 962,678 (see Brief for Petitioners, pp. 11-13). In this instance, however, it was used with petroleum distillate, which defendant has also used, present in the proportion of one pound to the ton of ore (0.05% on the ore). The superficial resemblance of this mixture to defendant's present mixture is therefore quite close, but the differences in the uses of these mixtures are fundamental and determinative. The Britannia mixture is used at a total proportion of two pounds to the ton (0.1%). The defendant's mixture is used at and above twenty pounds to the ton (1%). In the Britannia operations the minute amount of petroleums performs a useful function in economizing as to the cost of grinding. In defendant's operations the use of the larger amounts of petroleums is harmful and is proved to be unnecessary by defendant's own practice for years.

Commercial Use of the Invention — United States — Licensees.

The following is a full list of the licensees in the United States at the time of the trial (Ballot, Vol. V, pp. 2255, 2256, Qs1, 2):

Anaconda Copper Mining Company,
Arizona Copper Company of Arizona,
Arizona Copper Company, Ltd.,
Atlas Mining & Milling Company,
Atwater, M. W.,
Broadwater Mills Company,
Butte Central Mining & Milling Company,
Cananea Consolidated Copper Company,
Ceylon Company,
Chichagoff Mining Company,
Colusa Parrot Mining & Smelting Company,

Consolidated Arizona Smelting Company,
Desloge Consolidated Lead Company,
Doe Run Lead Company,
Ducktown Sulphur, Copper and Iron Company,
Dutch Sweeney Mining Company,
Elm Orlu Mining Company,
Ely Associates and Brockman & Co.,
Engels Copper Mining Company,
Flint Mines, Ltd.,
Goldfield Consolidated Mines Co.,
Highland Valley Mining & Development Company,
Inspiration Consolidated Copper Company,
McDonald & Noble,
Mineral Recovery Company,
Mountain Copper Company, Ltd.,
Napoleon Mining Company,
Old Dominion Mining & Smelting Company,
Phelps, Dodge & Co.,
Pingrey Mines,
Portland Gold Mining Company,
Reward Gold Mining Company,
St. Joseph Lead Company,
Stoddard Milling Company,
Utah Leasing Company,
Vindicator Consolidated Gold Mining Company,
Weedon Mining Company.

The licenses were all produced and handed to defendant's counsel for examination (Vol. V, p. 2256) and they made an abstract of such parts as they wished in evidence and this abstract was put in evidence (Vol. V, p. 2606) as Plaintiffs' Exhibit 291 (printed Vol. VI, pp. 3051-3068).

A full statement of payments of royalty by licensees in the United States (Vol. VI, p. 2964) shows a total payment of $1,155,258.24 on operations involving the treatment of 12,953,038 tons of material by eleven of the licensees, and the recovery of 227,070 tons of concentrates by eleven others of the licensees.

Neither the total tonnage of material treated nor the total tonnage of concentrates recovered appears in this statement, by reason of the variant methods of returns. So far as the evidence was available it was given of the processes employed by these licensees, and it appeared that the process of the patent in suit was carried on by every licensee of whose operations evidence was available. The inclusion of all patents owned by petitioners in the licenses, even the earlier patents for the Cattermole and other processes which were either never used in practice or (as to Cattermole only) the use of which was abandoned when the invention in suit came into use, and the inclusion of the soluble frothing agents patent No. 962,678 and all patents for improvements in process and apparatus which have followed the invention in suit, is appropriate in such licenses, but the basic and fundamental patent dominating all operations is the patent in suit. The royalties are paid, primarily, for the use of the process in suit, and the fact that the patent in suit has formed the basis for a great number of improvement patents merely accentuates its importance as a dominating and master patent for a process which started a new art, the art of air-froth flotation.

Anaconda Copper Mining Company. The adoption by the Anaconda Copper Company of the process of the patent in suit, involved the scrapping of going machinery worth more than $850,000 (Vol.. V, p. 2391, Qs24-26), the treatment of complex zinc ores which were theretofore worthless (p. 2303, RQs156-166), and the recovery from the accumulated dumps of the tailings of water concentration (p. 2395, Qs59, 60) of great values, estimated as involving a profit of more than four million dollars (pp. 2396, 2397, Qs65-68).

The adoption by this Company of the process in suit resulted in the treatment during the year 1916 of more than five million tons of copper ore (p. 2392, Q34), of which 3,800,750 tons of material were treated by flotation (p. 2393, Q37) resulting in the recovery of about one hundred million pounds of copper (Q39). The daily capacity is 3,000 tons of slimes (p. 2388, Q10) and 16,000 tons of sands (p. 2387, Q7),

or a total of 19,000 tons of copper material. This capacity is not attained by reason of the practice of holding certain machines in reserve.

In zinc, the ore, theretofore untreatable, was treated wholly by flotation (p. 2294, Q60). As recently completed this plant has a capacity of 2000 tons of ore per day (p. 2389, Qs15-17). It had concentrated and recovered about seventy-three million pounds of zinc up to the time of the trial (p. 2393, Qs40-42).

Thus the total daily capacity of the flotation plants at this mill is 21,000 tons of material treated or 7,500,000 tons per year.

The facts as to this great plant, the Washoe Reduction Works at Anaconda, Montana, are fully set out by Mr. Albert Edward Wiggin, flotation superintendent for the State of Montana of the Anaconda Copper Mining Company. The Anaconda Copper Mining Company employed the ordinary water concentration process from 1902 until the adoption of flotation, in the present Washoe Reduction Works, including, from 1912 to 1915, an improved system of water concentration known as the round table plant, developed by a Mr. Wheeler and Mr. Wiggin (Vol. V, p. 2382, Q5, and pp. 2401, 2402, RQ119-127), and in 1914, a novel leaching plant. Early in 1914 it was decided to investigate on a fairly large scale the treatment of slime and mill tailings by flotation. The details of this investigation are set out (pp. 2382-2386, Q6). Care and thoroughness characterized it. As a result it was decided to take a license from Minerals Separation and to remodel the plant for flotation and to scrap the round table plant and to divert the leaching plant to the retreatment of the sands dump. Altogether a going plant of the value of $859,098.23 was dismantled and scrapped (p. 2391, Qs24-26). The remodeling of the concentrator plant was begun in January, 1915, and proceeded, one section at a time, and was completed, the last of eight sections, about the middle of January, 1916 (p. 2382, Q5).

A full description of the remodeled copper plant is given (pp. 2387-2389, Qs7-13) in connection with flow sheets (Vol.

VI, pp. 2970-2974). It consists of eight sections of 2,000 tons a day capacity each. In addition there is a slime flotation plant having a capacity of about 3,000 tons a day, the feed to which is 2,000 tons of current mill tailings and 1,000 tons of the dump or pond slime. This latter is an accumulation of rejected slimes from prior water concentration processes, estimated on January 1, 1916, as 833,758 tons, containing 36,031,725 pounds of copper (Vol. V, p. 2395, Qs59 and 60, and p. 2388, Q11).

In the copper concentrator there is used for the copper sand, 3 to 3½ pounds of frothing agent (kerosene acid sludge) and from 6 to 8 pounds of sulphuric acid per ton of ore fed to flotation (p. 2387, Qs7, 8) and for the copper slimes 5½ to 6½ pounds of frothing agent (3 to 3½ pounds of kerosene acid sludge and 2½ to 3 pounds of wood creosote) and about 15 pounds of sulphuric acid (pp. 2387, 2388, Q9, p. 2392, Qs32, 33, and Plaintiff's Exhibits 313-315, Vol. VI, original paging 5555, 5556, following p. 3082).

The zinc concentrator plant is described at pages 2389, 2390, Qs15-18, in connection with flow sheet, Plaintiffs' Exhibit 244 (Vol. VI, p. 2973). This zinc concentrator was designed to treat 2,000 tons of ore per day.

In the zinc concentrator there is used 2¼ to 3½ pounds of oil (acid kerosene sludge .7 pounds and wood creosote 2.7 pounds) and 22 to 27 pounds of sulphuric acid, per ton of ore fed to flotation (p. 2389, Q18, and p. 2392, Q32, and Plaintiffs' Exhibits 313-315, *supra*).

To show the extent of use of flotation at the Anaconda mill, the figures as to copper concentration for the year 1916 are given by Mr. Wiggin (pp. 2392, 2393, Qs34-40). The total feed to flotation from newly-mined ore during 1916 in the copper concentrator was 3,800,750 tons of ore, having a copper content of 106,339,156 pounds. The tonnage of concentrate recovered by this flotation plant during 1916 was 576,417, containing 99,962,700 pounds of copper. The percentage of recovery by this flotation was 94% of the copper contained in the feed to

flotation plant (Qs37-40). The grade was about 8.07% copper (Qs51-55).

As to zinc concentration, the total tonnage treated from January, 1916, up to April 1st, 1917, was 292,493, containing 78,308,337 pounds of zinc (p. 2393, Q41). The recovery was 92.8% (Q42). The grade was approximately 33% zinc, a low grade by reason of the large iron sulphide content of the ore (Chapman, p. 2303, RQs156-166), but adapted to a novel electrolytic precipitation process carried on in Great Falls (Wiggin, p. 2393, Qs41-47).

Mr. Wiggin makes an estimate to indicate what would have been the value of the flotation process to the Anaconda Company in the years gone by, when water concentration was employed and when the reject of that water concentration ran to waste in the valley. He gives us the total tonnage of ore treated from the time the Washoe Reduction Works started in February, 1902, down to the 31st of December, 1915, as 35,877,-044 tons of ore containing, 2,408,629,436 pounds of copper (p. 2394, Q56). Of this the recovery of copper that was actually achieved by the processes actually used was 1,885,859,368 pounds (Qs57, 58). During that interval sand tailings had run to waste, the impounded remnant of which was estimated on December 31st, 1915, at 17,000,000 tons, containing .65% copper, or a total of 221,000,000 pounds of copper (Q59). In addition, slime from the mill prior to the use of the round table plant installation ran to waste, the impounded remnant of which was estimated on January 1st, 1916, at 833,758 tons, containing 36,031,725 pounds of copper (Q59). Mr. Wiggin, assuming that, through the years from February, 1902, to December 31, 1915, on the entire tonnage that was actually treated at the mill by water concentration from year to year, the flotation process had been used, as it was used during the year 1916, and had given the results it did give in 1916, figures that the additional recovery of copper from that tonnage would have been 353,010,773 pounds, and assuming the value of that copper at the average market price for copper current during

that term of years (figured with reference to the tonnage treated at the mill from year to year) less a reasonable charge for the cost of treatment, he shows that that value would have been $38,125,163 (pp. 2395, 2396, Qs61-64). The Anaconda Company did not earn that sum of money because it did not use the flotation process from 1902 to 1915. And this altogether disregards what would have been its increased capacity with flotation.

To show the value to the Company as an asset on January 1st, 1916, of the 2.16% of copper in the 833,758 tons remnant in the slime ponds on that day (a total loss under prior processes but an asset now because of the advent and adaptability of the flotation process as practiced in the slimes plant of the mill today) Mr. Wiggin figures that value, on a reasonable assumption as to the price of copper and after making liberal allowance for the cost of treatment and smelting and converting, as $4,032,000 (pp. 2396, 2397, Qs65-68).

It appears that the Anaconda Co. has a 2,500 ton leaching plant that is being used to treat by leaching the 17,000,000 ton sand tailings dump, the reject of former water concentration processes (p. 2399, XQs87-93, and p. 2401, RQs114-118). This leaching process and the idea of building this leaching plant all came before flotation was tested (RQ116). It was put in operation in May, 1915 (p. 2399, XQ88). The leaching plant was originally built to treat the sand tailings produced in the mill, the current tailings from the tables (p. 2401, RQ115). When flotation was tested, it was substituted as the process and the plant for treating the current mill tailings, and this then almost new and costly leaching plant was diverted to another and inferior use (RQs117, 118).

It appears also that the advent of flotation in the Anaconda mill destroyed the reasonable hopes of the witness Wiggin and his co-inventor, based upon their round table invention, which was the best slime concentrator of the water concentration class, and, as such, seemed to have a future (RQs119-127).

Mr. Chapman, who had charge of the experimental work of this installation as the representative of plaintiff Minerals Sep-

aration, Ltd., also testifies in general corroboration of the facts fully related by Mr. Wiggin (Vol. V, pp. 2293-2295, Qs47-66).

The frothing agents used, as above stated, are kerosene acid sludge (sometimes referred to as kerosene sludge acid and sometimes as sludge acid kerosene) and wood creosote. A creosote is a mixture of phenol compounds containing oils. Phenols are soluble frothing agents named in the solution patent (Vol. VI, p. 2920) and this substance in the various forms used in flotation, wood creosote and coal tar creosote, contains mineral-frothing oily material and soluble frothing agents. It is largely used as a frothing agent. Kerosene acid sludge is not kerosene oil at all, but is a by-product from the refining of kerosene oil, "the impurities taken out of the kerosene oil" (Vol. V, p. 2401, RQs110-112). It is an oily liquid which as used dissolves in water (Chapman, p. 2299, XQ110) and is therefore a soluble frothing agent. In the copper sands plant it is sometimes used alone at from three to three and a half pounds to the ton (0.15% to 0.175% on the ore) and sometimes with the wood creosote (Wiggin, Vol. V, p. 2387, Q7). In the copper slimes plant it is used in the proportions, above stated, but wood creosote is always added in the proportions above stated (p. 2388, Q9), so that the total frothing agent is from six to seven pounds per ton (0.3% to 0.35% on the ore). The copper slimes require more oil than the copper sands because of clay in the gangue which, as Mr. Wiggin says, "probably absorbed the oil and I presume rendered it useless for flotation" (p. 2392, Q33).

In the zinc plant the same frothing agents are used, but in smaller quantities, kerosene acid sludge 0.7 pounds per ton (0.035% on the ore) and wood creosote 2.7 pounds per ton (0.135% on the ore) (Wiggin, p. 2389, Q18), a total of 3.4 pounds per ton (0.17% on the ore).

During the testing period two petroleum oils, fuel oil and stove oil, were included in the various combinations tried (Wiggin, p. 2383, heading: Preliminary tests). The conclusions from the tests were that the best oil mixture was of kero-

sene acid sludge, wood creosote and stove oil, with "some question as to the real value of the stove oil" (p. 2384, par. 2). The use of this petroleum was of course in minute amount. As Mr. Chapman says "throughout the testing period, we used a little stove oil to assist in the uniformity of the work of the plant" (p. 2300, XQ125). Its use did not survive the testing period, however (Wiggin, p. 2399, XQs94, 95). As Mr. Wiggin says (p. 2400, XQ106).

> "we never considered stove oil as a flotation oil—and we do not use it now and have not used it since the plant started on large operations."

It was used in the testing period in minute amounts, associated with oily frothing agents and soluble frothing agents, and in these minute amounts it undoubtedly performed its usual function of preventing the coarser minerals from falling out of the froth, and when the grinding of the ore was improved, it was unnecessary and was not used.

Elm Orlu Mining Company and Colusa Parrot Mining Company—Timber Butte Mill.—The facts in this regard are testified to by Mr. William Nicholas Rossberg, metallurgical engineer for the Clark interests, and superintendent of the Timber-Butte Mill, Butte, Montana (Vol. V, p. 2423, Qs1-3).

The Elm Orlu Mining Co. and the Colusa Parrot Mining Co. are licensees under the patent in suit and the results of the process as employed at the Timber Butte Mill are of special interest because the Elm Orlu zinc ore is so nearly the same as the defendant's ore. This Court is familiar with the litigation as to the overlapping of these mines. This is the mill that was visited by Judge Bourquin at the conclusion of the trial and immediately after visiting defendant's mill.

At the Timber Butte mill there is both a zinc concentrator treating this Elm Orlu zinc ore, and a copper concentrator treating the reject or dump of the old reduction works of the Colusa Parrot reduction plant (Vol. V, p. 2423, Q5).

Mr. Rossberg gives a description of the zinc concentrator at p. 2423 Q6, to p. 2427, Q33, in connection with the flow sheet,

Plaintiffs' Exhibit No. 246 (Vol. VI, pp. 2976, 2977). This zinc concentrator was completed and put in operation in June, 1914, and has remained in operation ever since (Vol. V, p. 2427, Qs34-36).

The extent of use of the process in the zinc concentrator is set out at pp. 2429-2431, Qs59-80, and in Plaintiffs' Exhibit No. 249 (Vol. VI, p. 2980). The total tonnage of zinc ore treated up to the end of March, 1917, was 403,872 tons, of which 373,-707 tons was treated by flotation.

Plaintiff's Exhibit No. 249 (Vol. VI, p. 2980), produced and explained by Mr. Rossberg, shows the grade of flotation concentrate produced in this zinc section of the Timber Butte Mill as averaging, during January, February and March, 1917, 54.-474 per cent. in zinc content, and the recovery by flotation expressed in percentage of zinc as 97.72 per cent. (figured as the ratio of zinc in the concentrate to zinc in the flotation feed), and the tailings that ran to waste as containing .714 per cent. of zinc.

The copper section of the Timber-Butte mill is described by Mr. Rossberg at pages 2431, 2432, Qs81-84, in connection with the flow sheet, Plaintiff's Exhibit 250 (Vol. VI, p. 2981). It began operation in May, 1916, and has been in continuous operation ever since (p. 2432, Qs85, 86).

The total tonnage treated up through March, 1917, was 89,-453 dry tons from the Colusa Parrot dump (p. 2432, Q87). The average amount of oil used during 1916 was 2.83 pounds per ton of flotation feed, and during the first three months of 1917, 2.28 pounds per ton (Qs88, 89). The acid used in 1916 averaged 9.38 pounds per ton, and for the three months of 1917, 5.87 pounds per ton (Q90).

The Colusa Parrot dump, which the copper section of the Timber-Butte mine is treating, is a reject of former water concentration processes and contains approximately 900,000 tons, showing an average of 1.05% copper, which at the market price of 25 cents per pound for copper, represents a present net value, in view of the adaptability of flotation to treat it, of $1,-800,000 (pp. 2453, 2454, Qs95-102).

The oil and acid consumption of both the zinc and the copper sections are set out at pp. 2427 to 2429, Qs37-58, and Plaintiffs' Exhibits 247 and 248 (Vol. VI, pp. 2978, 2979). The average for 1914 was 0.66 pounds of oil per ton of flotation feed and 10.17 pounds of acid; for 1915, 1.05 pounds of oil and 9.94 pounds of acid; for 1916, 0.70 pounds of oil and 10.19 pounds of acid. The highest average of oil is 0.052% and the lowest 0.035% on the ore.

The oils used include various mineral-frothing agents, including the fatty acid oleic acid (during the first three months only) and turpentine, pine oil, various wood creosotes, coal tar creosotes, refined coal tar and kerosene acid sludge. In the list of 32 oils there is but one petroleum item. This is No. 110, a fuel oil and therefore ineffective in the process in suit. It was used only during November and December, 1915, and in conjunction with numerous other oils which were mineral-froth-forming and included soluble mineral-froth-forming constituents, and it was used in minute amounts.

Mr. Chapman also testifies as to this installation (Vol. V, pp. 2292, 2293, Qs42-45).

Maxwell W. Atwater.—Mr. Atwater is a licensee of petitioners, living in Basin, Montana, and applied the process in suit first to the Basin dump of the Butte & Superior Mining Co. (defendant) at that place, and later to a copper tailings dump at the same place. His testimony describing this work is found in Vol. V, pages 2305-2310.

The Basin dump of the Butte & Superior Copper Co. consisted of a remnant of about 50,000 to 60,000 tons, as treated by Mr. Atwater (p. 2307, Q14). It was the reject or tailings from from the water concentration processes that had been employed there by the defendant for two years ending about May, 1912, in the treatment of some 300,000 tons of ore (Q13). These tailings were reground by Mr. Atwater and concentrated by flotation in a standard Minerals Separation machine and a sub-aeration cleaner machine, beginning in June, 1914, and continuing until the dump was exhausted. The grade of concen-

trate averaged better than 54% zinc, sometimes reaching over 57% for months at a time (p. 2308, Q25). The recovery was 90% or a little better (Q26). At first about six pounds of oleic acid was used and two to four pounds of sulphuric acid were used per ton of ore. Later turpentine and pine oils were employed in place of oleic acid and only one or two pounds, either mixed together or separate, and as high as 15 pounds of acid (Q29). The profit over and above all expenses averaged about $45.00 per ton of concentrate (Q36).

To indicate the loss suffered by defendant prior to May, 1912, Mr. Atwater has made a calculation showing that if the entire 300,000 tons of ore which were treated at Basin by water concentration processes prior to May, 1912, had instead been treated by the flotation process as employed, and with results obtained by Mr. Atwater after June, 1914, the defendant would have made a profit of upwards of $1,000,000 more on that ore than it did make (Vol. V, pp. 2310, 2311, Qs58-63, and p.2577, Qs1, 2, and Plaintiffs' Exhibit 274, Vol. VI, original paging 5441, 5442, following p. 3022).

The copper tailings dump at Basin under treatment by Mr. Atwater, known as the Heinze dump, contains 60,000 to 80,000 tons (Vol. V., p. 2322, RQ226), having a copper content of 1.25% (p. 2309, Q39). This is being subjected to petitioners' flotation process, with acid and heat and about 3 pounds of oil mixture to the ton of ore, this oil mixture being composed of pine oil, tar oil, creosote, sludge acid (kerosene acid sludge) and kerosene oil (Q45), the kerosene oil at less than a quarter of a pound to the ton of ore (Q46), about 0.012% on the ore. The recovery is about 90% (Q50) and the grade of concentrate about 9% copper (Q51), which is profitable (Q55) and is in fact slightly higher than the standard of the Anaconda Copper Mining Company, 8.07%, and is a desirable and profitable grade for the Montana copper region (Wiggin, p. 2394, Qs53.54).

The Inspiration Consolidated Copper Company.—The mine and mill of this company are located in Miami, Arizona. It is

one of the great porphyry companies, with an ore containing only about one and a half per cent. of copper. As now installed it uses exclusively the subaeration type of agitation, including Callow cells and other subaeration apparatus. The facts are set out by Mr. Greninger at Vol. V, p. 2265, Q27 et seq. After a six months' test from January to June, 1913, on a small 50-ton standard Minerals Separation plant, a larger 600-ton plant was built, beginning January, 1914, (p. 2266, Qs42-45). Out of this grew the present installation, which was commenced in 1915 (p. 2280, XQ248). There are at present nineteen sections in use, and the twentieth section nearing completion (p. 2267, Qs50-52) having a total capacity of about 18,000 tons of ore a day (Qs53-54) or about 6,500,000 tons per year. The oil used is about one and a half pounds of a mixture of crude tar oil and cresol (p. 2270, Qs87-89). The original ore contains 1.54% copper (Q85). The recovery of the copper that is in the form of sulphide is over 90 per cent. (p. 2277, XQ205). A shaking table water concentration treatment follows after flotation (p. 2270, Q82, p. 2277, XQs197, 198), but the amount recovered in that way is only 2 or 3 per cent, of the total recovery (p. 2287, RQ327).

The flotation machines of four mill sections are Callow cells; one section has a Minerals Separation machine of the Hebbard (subaeration) type; the other fourteen sections are special machines of the Inspiration type (p. 2267, Q50).

The Callow cells have been heretofore described. The Inspiration type is described (p. 2268, Qs64-66) and is in essence the same as the Callow cell, and as Mr. Greninger says the compressed air supplied underneath through the porous bottom "acts the same as in the Callow machine; it agitates and aerates the mixture" (p. 2269, Q67). The Minerals Separation Hebbard type (subaeration) machine receives air at the bottom, but the air, instead of being subdivided by being forced through a porous false bottom, enters by pipes and is subdivided by revolving impellers, and baffles above the impellers restrain the swirl of the liquid (Qs68-75).

Mr. Chapman assisted in this installation, and briefly outlines his connection with the work in corroboration of Mr. Greninger (pp. 2290, 2291, Qs13-23).

Consolidated Arizona Smelting Co.—Mr. Chapman testifies as to an inspection of this plant wherein a standard Minerals Separation machine was operating on copper ore, using between 2 and 3 pounds per ton of ore of a frothing agent consisting of a mixture of Caroline turpentine (an essential oil), fuel and stove oil, with recoveries in the neighborhood of 80%, which have been considerably increased, and on his last visit in 1916 were 93 or 94% (pp. 2291, 2292, Qs24-40). The use of the two mineral oils, fuel oil and stove oil, in minute amounts and in the presence of the essential oil turpentine, which, like all essential oils, contains soluble frothing agents, calls for no special comment here.

Old Dominion Mining & Smelting Co.—Mr. Greninger briefly described this installation as first made in 1913 (pp. 2287, 2288, Qs329-335). Here the material treated was absolute waste before the process of the patent in suit was installed (Qs333, 334). In 1916 Mr. Chapman visited this plant (p. 2295, Q67) and found it in operation using the largest amount of frothing agent in Mr. Chapman's experience, a little over 7 pounds of frothing agent per ton of ore 0.35% on the ore, (pp. 2295, 2296, Qs71-73). This company had not paid any royalty up to the time of the trial, although its operations have been carried on over a considerable period of time, but having contracted to do so by license agreement and having installed and used the process in suit over a period of years, it certainly has afforded evidence of the value of the process in suit. It should be added that since the trial it has paid its indebtedness in royalty and is cheerfully living up to its contract.

Atlas Mining & Milling Co.—Mr. Greninger describes this installation, made in the fall of 1913 (Vol. V, pp. 2271, 2272, Qs102-110). Here the ore was a lead-silver ore containing about 2% of lead and 10 to 14 ozs. of silver per ton of ore. Crude carbolic acid was the principal frothing agent, used in

the proportion of from 1 to 1½ pounds per ton of ore. The recoveries were 90% of the lead and 80% to 85% of the silver, the concentrates containing 20% of the lead and 100 ozs. of silver per ton of concentrate. It may be noted that if the carbolic acid had been pure and used alone, it would have been pure phenol, a soluble frothing agent, but evidently in its crude form and used with other frothing agents it involved the presence of an oily frothing agent.

Dutch Sweeney Mining Co.—This is a gold mine, with an ore assaying between $3 and $4 per ton (Chapman, Vol. V, p. 2304, RQ170), and concentrates obtained are valued at nearly $40 per ton (RQ172). They have a Minerals Separation sub-aeration machine (RQ169).

Other Licensees in the United States.—Mr. Chapman testifies to visiting the properties of the St. Joseph Lead Company, the Doe Run Lead Co., the Portland Gold Mining Co., the Vindicator Gold Mining Company and the McDonald and Noble installation, at all of which flotation had been installed under the direction of the plaintiffs (Vol. V, p. 2295, Q67).

Commercial Use of the Invention — United States — Infringers.

Chino Copper Co.—The facts as to the use of flotation by this Company at its plant in Hurley, New Mexico, are proved by the defendant. Mr. Wicks, Assistant Superintendent of the mills of this Company, describes the operations at length (Vol. III, p. 1430, et seq.) and produces tabular statements said to set forth all of these operations. Defendant's Exhibit 29 (Vol. VI, original paging 4990, following page 2736) is the final tabular statement of the plant treating vanner concentrates, and Defendant's Exhibit 125 (Vol. VI, p. 2849) is the final corrected tabular statement of the plant treating slime vanner tailings. The concentrates plant treated, from December, 1914, to March 31, 1917, a total of 223,775 tons of the finer low grade concentrates from water concentration, with an average recovery of about 94% and an average increase in

grade from 7.97% of copper to 29.62% of copper. The material treated was so fine that screen analysis did not show anything, 90% of it went through a 200 mesh screen (Vol. III, p. 1452, Q71). The slimes plants treated 2,064,070 tons, with an average recovery of about 33% of the copper, and an average increase in grade from .804% copper to 25.35% copper. This material, the slimes reject of water concentration, was considerably finer than the vanner concentrates (p. 1458, Qs127-130). The low recovery was due to oxides and carbonates of copper which were not recovered by the process, and are ordinarily not recoverable by flotation (pp. 1459, 1460, Qs136-141).

The slimes plant operated throughout this entire period with an average of 1.13 lbs. of oil per ton of ore or material treated, .056% of the ore. No change was made in this plant after the decision of this Court, and in the first quarter of 1917 the tonnage treated was 388,420, and the average oil per ton was 1.04 lbs., or .052%. A few experimental runs were made, however, with varying amounts of oil, at times more than a fraction of one per cent. of the ore, but these were of such small account that the average oil for the quarter was less than for the entire year 1916.

The smaller vanner concentrates plant with a yearly tonnage of only about 100,000 tons, as compared with a yearly tonnage of one and a quarter million tons of the slimes plant (see total tonnages of 1916 in Exhibits 29 and 125), was selected for demonstration of the possibility of running a flotation plant over a period of months with more oil than a fraction of one per cent. (and more oil than the former operations had shown to be necessary) and commencing December 21, 1916, ten days after the decision of this Court, the oil used averaged 23.38 pounds per ton of ore, 1.17% of the ore. The method of bringing this about was exceedingly simple. Before this change was made the oil used was a mixture containing 90% Barrett creosote (an impure material containing effective or mineral-froth-forming oil and soluble frothing agent) and 10% Jones oil (a fuel oil ineffective in the process in suit but some-

times, and evidently in this instance, useful in minute proportions with a soluble frothing agent). The mixture was changed to 10% Barrett creosote and 90% Jones oil (Vol. III, pp. 1448, 1449, Qs41-44). From December 1 to 20, 1916, the oil mixture used averaged 12.39 pounds per ton, which contained at least 10% of ineffective oil, and in fact more ineffective material by reason of the impurities in the creosote. From December 21, 1916, to March 31, 1917, the oil mixture used averaged 23.38 pounds per ton and contained 90% of ineffective oil. By reason of the impurities in the creosote, the net result undoubtedly was the use of about the same amount of effective mineral-froth-forming oil at all times.

The above noted fact that the material used at this mill which contains the mineral-froth-forming oil and the soluble frothing agent, is a crude material containing a considerable proportion of impurities—a coal tar distillate from the well-known roofing concern, the Barrett Company of Chicago (p. 1476, Qs288-291), would seem to account for occasional freakish operations at this mill, as for example the use on November 20, 1916, of 4500 lbs. of Barrett creosote (Vol. IV, p. 1714, Q27) in treating 179 tons of ore (Vol. VI, original paging 5234, following p. 2912), or 25.1 lbs. of creosote per ton of ore, when the average total of all oils for the year 1916 was only 10.24 lbs. per ton and for the month of November, 1916, 13.71 lbs. per ton. But petitioners' representatives were not present at any of the operations at this mill.

Janney Machines. The machines used were Janney machines, invented in 1913 and later (Janney, Vol. III, p. 1534, XQs217-224). These machines are also used by the defendant. These machines subject the pulp to a very violent agitation, much greater in degree than the standard machine of petitioners. Defendant's witness Conrads admits that this is "a terrific agitation" (p. 1594, XQ387), and defendant's witness Wicks says that the pulp is so violently agitated that it is "almost a mist" in the agitating chamber (p. 1457, Q115). By reason of the excessive aeration resulting from this terrific agitation. this machine lends itself to masking the operations of the

process in suit by excessive quantities of ineffective oil. It was invented by Mr. Thomas A. Janney, a capable metallurgist who has been active in the affairs of the Jackling group of mines (F. G. Janney, Vol. V, p. 2654, XQs49-52), including with the defendant, the Chino Copper Company, the Ray Consolidated Copper Company, the Utah Copper Company and the Nevada Consolidated Copper Company (p. 2649, Q4), whose metallurgists have assisted the defendants, whose mills have been utilized for the expensive tests and operations to aid the defendant, and all of whom are admittedly guilty of infringement of the patent in suit. This Janney machine is used by all of the infringers who assisted in the defense, as well as by the defendant.

The Janney so-called mechanical type machine is described by Mr. Wicks (Vol. III, pp. 1456-1458, Qs104-125) in connection with a very crude sketch, Defendant's Exhibit No. 27 (Vol. VI, original paging 4988, following p. 2736). The construction of the machine is much better shown in Mr. Janney's first issued patent No. 1,167,076, of January 4, 1916 (printed Vol. VI, p. 2737, et seq.). Another patent to him, No. 1,201,053, issued October 10, 1916 (printed Vol. VI, p. 2744, et seq.), shows his laboratory or test machine, which was used in court room experiments and is in evidence, Defendant's Exhibit No. 185, and a drawing of which is in evidence, Defendant's Exhibit No. 183 (Vol. VI, p. 2905). It is of the same type as the large machine and produces the same excessive agitation. Another and more recent type of this machine, the mechanical-air type, is the same as the mechanical type, except that it contains in the spitzkasten a false bottom covered by a porous medium through which compressed air is forced so that aeration resulting from the terrific agitation is supplemented by subaeration, with its accompanying agitation, in the spitzkasten (Vol. III, p. 1458, Qs121-124). Both types of machines are used by all of the mines of the Jackling group above referred to, including the defendant.

Utah Copper Company—Arthur Mill. The facts are stated by Mr. Thomas A. Janney, superintendent of the Mill (Vol. III, p. 1509, et seq.) as a witness for the defendant, and the

operations of one of the flotation plants at this mill, called the retreatment plant, because it treats a low-grade vanner concentrate, are shown in Defendant's Exhibit 30 (Vol. VI, original paging 4993, following p. 2736). It appears that after about two years of experimental investigation, beginning in 1913, the Utah Copper Company, at its Arthur Mill, adopted flotation on a commercial scale, commencing in February, 1915, and from that time up to December 21, 1916, it treated in this retreatment plant 420,285 tons of low-grade concentrate of an average of about 7% copper and obtained high-grade concentrates of an average of about 27% copper, using oil in a proportion averaging 3.76 lbs. per ton of ore or material treated, .19%. On December 21, 1916, ten days after the decision of this court in the Hyde case, this particular plant was changed over to use larger quantities of oil. For ten days to and including December 31, 1916, the amount of oil used was 23.95 lbs. per ton, 1.2%. In January, 1917, it dropped to 19.73 lbs. per ton, or 0.99%, and in February and March, 1917, it dropped to 15.39 and 15.33 lbs. per ton, respectively, an average of 0.77%. The regular operations reported stopped during March. From March 25 to April 8 experiments were carried on with the employment for the greater part of the time of an unusually large and wasteful amount of oil, and in a few experiments of an insufficient amount of oil, the average for these days being 39.13 lbs. per ton, or 1.96%. These experiments produced a very material impairment of the operations, and the great loss in the tailings is explained by a footnote as due to "extensive experimenting with oils." The average for the entire period from December 22 to April 8, was 18.81 lbs. per ton, or 0.94%, and the average of the regular operations very much lower. It thus became impossible in this selected plant at this mill to carry on the process of the patent in suit with one per cent. or more of oil, and coincidentally with the drop in January, 1917, to a fraction of one per cent. of oil, a method of calculation was hit upon for the purpose of increasing the figures alleged to represent the amount of oil used. Oil which had

already been used in the process and was returned with an unfinished concentrate or middling, was denominated as circulating oil and added to the oil actually used in the process, and the result was called "total oil," and this in January raised the average figure to 20.75 lbs. per ton, or 1.04%. In February, even this method of calculation failed to bring the figure up to 20 lbs. per ton or 1%, the actual figure being 18.30 lbs. per ton or 0.91%. In March the average of this so-called total oil was 20.26 lbs. or 1.01%. This erroneous method of calculation is considered under the heading "Circulating Middlings" (*infra*, pp. 123-127).

There is also at this Arthur Mill a much larger flotation plant for the treatment of vanner slimes, the very fine reject of the water concentration of the mill. Mr. Janney describes this material as "very fine slime" (Vol. III, p. 1523, Q129) 75% of which will pass through a 200 mesh screen (Q128). This plant is so large that to operate it at 20 lbs. of oil to the ton of ore would require 10,000 gallons of oil per day (p. 1527, Q171), whereas the retreatment plant requires under like conditions only 1500 gallons per day (Q174). The flow sheet of this plant was demanded and obtained (Vol. IV, p. 2163, XQs119, 120; Vol. VI, p. 2926) and is described (Vol. VI, pp. 2163, 2164, XQs121-128). This flotation plant was being operated at the time of the trial without waste of oil, the oil used being in the proportion of 1.4 lbs. per ton of ore, 0.07%, and with recoveries of about 90% (Vol. III, p. 1544, XQs332-336). The cost of wasting oil in operating this large plant was evidently prohibitive, even for argumentative purposes.

Thus we find that at this Arthur mill the most strenuous efforts had failed to produce any regular operations in any flotation plans employing more oil than a fraction of one per cent. on the ore. Indeed the confinement of the claims of the patent imposed by the Circuit Court of Appeals, to one-half of one per cent. as the upper limit, would only save this infringer from the consequences of its infringement as to what was done in its smaller flotation plant during the evidence-making operations in the few months following the decision of this

Court in the Hyde case and preceding the trial of the instant case.

The experimental runs above referred to are considered in detail under the heading—Petroleum Oils used by defendant are not Mineral-Froth-Forming oils, *infra*, pp. 136-138.

Utah Copper Company—Magna Mill. The facts as to the operations of one of the flotation plants at this mill, the retreatment plant, are set out by Mr. Conrads, metallurgical engineer at this mill (Vol III, p. 1554, et seq.) as a witness for the defendant, and figures up to and including December 24, 1916, are given in Defendant's Exhibit 35 (Vol. VI., original paging 5015, facing p. 2752). It appears that the use of the process in suit began in this mill in September, 1914, and that in the period of two years and nearly four months covered by Exhibit 35, 568,163 tons of very fine low grade concentrates of water concentration were treated. The oil averaged 3.79 lbs. per ton of ore, or 0.19% of the ore. The concentrate was raised from the average grade of 8.35% copper to 21.01% of copper. The indicated recoveries averaged 97.46%. These operations were therefore highly satisfactory. On December 25, 1916, fourteen days after the decision of this Court in the Hyde case, the amount of oil was increased (Defendant's Exhibit 36, Vol. VI, original paging 5016, following p. 2752), and during the remainder of that month averaged 15.93 lbs. per ton of ore, 0.8%. This failed of the goal of the effort, and during January the average was slightly increased to 18.41 lbs. per ton, or 0.92%, which still failed of the goal. During this month, however, the new method of calculation, which included oil already used with the oil added by measuring the amount of oil in the circulating middling or unfinished concentrate, was adopted, and this brought the so-called total oil up to 22.10 lbs, per ton, 1.1%. In February, 1917, the amount of oil actually used was diminished to 11.32 lbs. per ton, 0.57%, but by adding the already used oil in the circulating middlings, the so-called total was brought up to 23.21 lbs. per ton, 1.16%. In March careful watching produced the desired average of so-called total oil 20.62 lbs. per ton, 1.03%, but with new oil, or oil actually used, at only 14.88

pounds per ton, 0.74%. In April the seven days shown in the table were largely given over to experiments, with consequent large losses in the tailings, and here the average of oil actually used was 14.81 lbs., 0.74% and the so-called total oil only 16.08 lbs., 0.8%. The average of all of the oil wasting operations was 15 lbs. of oil to the ton, 0.75%. The operations exhibit a careful and futile effort to avoid using an amount of oil which does not exceed a fraction of one per cent. on the ore. They significantly show that this infringer needs the limitation imposed by the Circuit Court of Appeals to evade the patent.

Tables of daily operations commencing December 25, 1916, were demanded and obtained, Defendant's Exhibits 39-43 (Vol. VI, original paging 5023, 5025, 5027, 5029, 5031, between pp. 2752 and 2753), and these show that an oil mixture was used during December and early January containing 95% of Jones oil (a fuel oil equivalent ineffective in the process of the patent in suit) and 5% of pine oil (a combination of mineral-froth-producing oil and soluble frothing agent) followed by increase of the ineffective oil to 97% and diminution of the active frothing agents to 3%, and numerous struggles with oil mixtures resulting finally in the latter part of March in a mixture containing 87½% of ineffective petroleums and 12½% of creosote, the latter containing mineral-froth-producing oil and soluble frothing agent and useless impurities.

At this Magna Mill there is also a slimes flotation plant, installed by Mr. Thomas A. Janney in the latter part of 1914 (Vol. III, p. 1523, Q130). The amount of oil used in this plant during 1914 was in the neighborhood of from 1 to 5 lbs. per ton of ore (Qs131, 132). In April, 1916, it was found that by sulphonating the active frothing oils creosote and pine oil, excellent results could be obtained (Q133). Nothing further appears about this plant except the statement of Mr. Janney that if all the flotation plants at the Arthur and Magna Mills were changed over so as to use 20 lbs. of oil per ton of ore, it would require 87,500 gallons of oil per day (p. 1527, Q175). He also says that for the retreatment plants, the particulars of

the operations of which are given, it would require about 1500 gallons per day at each plant (Q174), and that from the slimes plant at the Arthur Mill (which continued to run with a small fraction of one per cent. of oil) it would require 10,000 gallons of oil per day (Q171). These figures leave an amount of 74,500 gallons of oil per day as required for operating the slimes plant at the Magna Mill under the oil-wasting conditions of the use of 20 lbs. of oil to the ton of ore. This slimes plant therefore is the greatest of all the flotation plants of the Utah Copper Company, and the expense of wasting oil in it being prohibitive, it was evidently not altered or experimented with in this direction. Indeed, it is quite obvious that it is not practicable to operate these great slimes flotation plants at these two mills with a waste of oil.

One other point of interest in these oil-wasting operations is very striking with the arrangement of flotation machines used in the so-called retreatment plants at the mills of the Utah Copper Company, and is true to some extent as to all of the oil-wasting operations. This is the arrangement of flotation machines in series, so that each subsequent machine after the first machine operates upon a pulp mixture in which the proportion of oil to material treated is constantly diminishing. In the Magna Mill there are seventeen flotation machines in series, each subsequent machine receiving the tailings of the preceding machine (Flow Sheet, Plffs. Ex. 245, Vol. VI, p. 2974). The first machine produces a floating product in its spitzkasten which, in oil-wasting operations, contains a very large proportion of oil, and this product overflows, and, mixed with that of the other spitzkastens which produce finished concentrate, goes out of the system. Thus a great amount of oil is ejected from the system in the first operation of agitation and flotation, and each succeeding operation ejects oil. These operations were inspected by petitioners' representatives at an exhibition of this particular flotation plant, during the trial, and are confirmed by defendant's assays of the products of the exhibited operations. Each successive

machine down the line operates upon tailings containing a smaller proportion of oil than the material operated upon by the preceding machine, and the oil proportion is stepped down from machine to machine of the seventeen machines in series. This was admitted by Mr. Conrads at an early stage of the testimony (Vol. III, pp. 1594-1597, XQs381-414), and later when the machines were exhibited, the actual assays of the products, as proved by the defendant, showed that with the use of 21.32 lbs. of oil to the ton of ore (Vol. VI, p. 2983) the overflow of the first spitzkasten contained 412.31 lbs. of oil per ton of product 25.97% (p. 2984), the overflow of the second spitzkasten 96.75 lbs. of oil per ton of product, of the third spitzkasten 55.72 lbs. of oil per ton, of the fourth 28.72 lbs. of oil per ton (p. 2985), and the combined sample of spitzkastens 1-10, 46.88 lbs. of oil per ton of product (p. 2987). the tailings fed from machine No. 11 as the pulp to be treated in machine No. 12 contained only 6.60 lbs. of oil per ton of product, 0.33% (p. 2988) and the tailings fed from machine No. 11 as the pulp to be treated in machine No. 12 contained only 5.75 lbs. of oil per ton of product, 0.29%. The original oil proportion of 21.32 lbs. of oil, or 1.08% must have been diminished to a fraction of one per cent. in the first machine, with its overflow containing 412.31 pounds of oil to the ton of product. This machine was in fact merely an oil extractor. The remaining sixteen machines were undoubtedly treating a product containing only a fraction of one per cent. of oil (see *infra*, pp. 182-184 for further details of this exhibited operation).

In the Arthur Mill retreatment plants there is this same arrangement of a great number of machines in series with the overflow of the earlier spitzkastens ejected from the system, the second machine treating the depleted product of the first, and so on (Flow Sheet, Vol. VI, p. 2924). One set of machines has 13 machines or cells in series and the other 15 machines or cells in series. Thus these retreatment plants were peculiarly well adapted for performing experiments with large

amounts of oil initially used, but the excess speedily ejected from the systems.

An experimental run was carried on at the Magna Mill for the expressed purpose of demonstrating that better results can be obtained with more than one per cent. of oil than with less than one per cent. of oil, but the whole calculation is based upon the addition of oil in circulating middlings to oil actually used, and is worthless, even though on its face, it demonstrates that diminution of the mineral-froth-forming oil, pine oil, below critical proportions, actually explains the increased losses. This character of evidence is not now of any importance, since defendant admits that its operations with one per cent. or more of oil are metallurgically inferior and financially expensive as compared with operations not thus camouflaged, and asks to be permitted to continue them for that reason.

Ray Consolidated Copper Co.—The facts are stated by Mr. Englemann, flotation foreman of the Company, as a witness for defendant (Vol. III, p. 1605 et seq., Vol. IV, p. 1860 et seq.). The operations are shown in tabular statements, Defendant's Exhibit 150, Retreatment plant (Vol. VI, pp. 2873, 2874) and Defendant's Exhibit 151, Tailings Plant (p. 2875). It appears from Exhibit 150 that flotation operations on the retreatment of vanner concentrates began during the fourth quarter of 1914, and continued up to the trial, during which time about 379,651 tons of material were treated, and that the oil employed was between 4 and 5 lbs. per ton in 1914 and 1915, between 3 and 4 lbs. per ton in 1916; and, in 1917, 20.02 lbs. per ton in January (1.001%), 18.77 lbs. per ton in February (0.94%) and 21.19 lbs. per ton in March (1.06%) the average for the three months being 20.1 lbs. or 1.05%.

Here also, when, during January, 1917, the oil used hovered so close to one per cent. as to show that it would have to be dropped below one per cent., as occurred in February, the expedient of adding used oil to new oil was adopted, and in February this gave a figure of 1.07%, or 21.4 lbs. per ton, but strangely in March this expedient reduced the given total figure to 0.97%, 19.4 lbs. per ton. The figures based on cir-

culating middlings are, however, altogether deceptive and unworthy of consideration. It is noted that an expert oil chemist was employed to determine the amount of oil in the circulating load or circulating middlings, who spent something more than two months on the problem (Vol. III, p. 1611, Q54).

The same change in oil mixtures was made in this mill as in the other infringing mills, when changing to oil-wasting operations. Before 1917 the mixture contained 75% of creosote, with its useful frothing agents, and 25% of fuel oil, an ineffective oil and useful only in minute proportions when the process of the soluble frothing agents patent No. 962,678 is carried on. Creosote contains a soluble frothing agent, and this minute proportion of fuel oil, less than a pound to the ton of ore, performed the only useful function that it can perform in flotation, of assisting to prevent coarser mineral from falling out of the froth produced by a soluble frothing agent. When the change was made to larger oil proportions the mixture was changed to 10% of creosote and 90% of fuel oil (Vol. IV, p. 1865, Q37). Thus was added a wasteful, useless amount of an oil ineffective in the process in suit. From less than a pound it became about 9 lbs. while the creosote, which contained the mineral-froth-producing oil and which during 1916 was present in the proportion of about 2½ lbs. per ton (75% of 3.36) was now present in the proportion of about 2 lbs. (10% of 20). So far as the process in suit is concerned, the operation was substantially the same before January 1, 1917, as after that date. So far as the process of the soluble frothing agents patent is concerned, the soluble frothing agent was present in about the same proportion before and after January 1, 1917, but the minute amount of ineffective and non-frothing oil which had helped it before January 1, 1917, was changed into an unconscionable and wasteful amount which impaired the process as a whole but did not prevent its operation.

The other flotation plant at this mill, that for treating the slime tailings, deals with a product which admittedly went to waste before flotation was installed (Englemann, p. 1877, Qs139-141). Its operations, commencing with the second

quarter of 1915 and up to the end of 1916, are shown in Defendant's Exhibit No. 151 (Vol. VI, p. 2875). A total of 1,998,088 tons of this formerly waste product was treated in 1916 and the average amount of oil used was 0.85 lbs. per ton of ore, 0.04%. These operations have continued with the "usual amount of oil" (Vol. IV, p. 1873, XQ87). This plant treats 7,000 tons of material a day (p. 1861, Q8), and evidently the cost of wasting oil in it was prohibitive, whereas the retreatment plant only treats 350 tons per day (*ib.*) and the waste and injury to operations was not so serious. All that the table shows of the operations of this great plant during 1917 are a few experiments with portions of the plant, as described in the footnote to the table. The earlier of these experiments were with straight coal tar, a mixed product which appears to possess the same character and constituents as the mixture of 90% of petroleum fuel oil and 10% of creosote which was used at other times in these larger oil operations. It is interesting that the operations from February 8 to March 14 were obtained in the air machine (pneumatic or Callow type) annex of the mill, sketched in Defendant's Exhibit No. 149 (Vol. VI, p. 2872). On February 18, 1917, the amount of coal tar used was exactly 20 lbs. to the ton of ore (Vol. IV, p. 1877, XQ134) and on the other days of this run the oil at times went above 20 lbs., and at times below 20 pounds (XQ135), the average of the run from February 8 to 28 being 20.1 lbs. of coal tar per ton of ore (1.005% on the ore).

It may be noted as to all of these operations of the infringers who assisted the defendant, in so far as they have been disclosed, that they demonstrate that with mixtures of mineral-froth-producing oils, of soluble frothing agents, and of ineffective oils, such as were invariably used, there is no one per cent. barrier, and certainly no one-half of one per cent. barrier.

Mr. Englemann frankly admits that efforts were made to operate at his plants on straight fuel oil at various times (Vol. IV, p. 1871, Q78),

"but we could never maintain metallurgical results."

This is equally true as to all operations, although efforts were made by others of defendant's witnesses to mask their operations and hide the fact that a soluble frothing agent was always present, whether dissolved in the water of the pulp returned as middlings or in water re-claimed from operations of preceding days or fed into the pulp during the experimental runs.

Nevada Consolidated Copper Co. The operations of this member of the Jackling group of mines were not put forward in this case by the defendant but were extracted in cross examination from Mr. Frank G. Janney (Vol. V, p. 2655, XQs53-59; p. 2656, XQs66-68). It appears that this company was infringing the process in suit in 1914, using from 2½ to 3 lbs. of oil per ton of ore, in Janney machines, and that it employed both soluble frothing agents and insoluble oily mineral-frothing agents.

Infringement — The Facts.

The procedure in defendant's mill covers three periods.

First, the procedure involved as the infringement in the Hyde case (August, 1911),

Secondly, the procedure from that date to January 7, 1917, and

Thirdly, the procedure from January 9, 1917 to April 15, 1917.

The first procedure has been held by this Court to be a clear infringement. This Court briefly said (242 U. S., 271):

> "The evidence of infringement is clear."

The second procedure was admitted by defendant's counsel to be an infringement, and upon that admission the Circuit Court of Appeals so decreed.

The third procedure raises the only issue of infringement that is made.

The facts as to these three procedures are briefly these:

1. In August, 1911, oily liquid and acid and heat were used and vigorous agitation. The oily liquid, was oleic acid and

3.2 lbs. of it (.16%) per ton of ore was used; also about 1 lb. of sulphuric acid; and a moderate heat.

2. From August, 1911 to January 7, 1917, the procedure always included oil or oily liquid and acid, and heat, and vigorous agitation.

The oily liquid oleic acid was first used alone. Later it was mixed with pine oil, and pine oil used either alone or mixed with oleic acid in about half and half proportions. Pine oil was first used in June, 1913 (Dosenbach, Vol. IV, p. 1964, XQ442) for one day's run (XQ446), and commencing in July, 1913, the general procedure of using pine oil mixed with oleic acid was continued until the latter part of 1914 (XQs447, 448). Then pine oil was used alone, with slight occasional variations, commencing in December, 1914, and continuing until December 22, 1916 (XQs452, 453).

Defendant sets forth these operations in Defendant's Exhibit No. 158 (Vol. VI, original paging 5185, facing page 2882), commencing with the first quarter of 1913. During this quarter the average amount of oleic acid was 4.76 pounds per ton, or 0.24%. In the second quarter this was increased to the maximum of 9.82 pounds per ton, 0.49%. This was just within the upper limit of the "oleic acid" claims. During the third quarter, when pine oil was regularly used, mixed with the oleic acid, the average was 4.14 pounds per ton, 0.2%. The average for the year 1913 was 5.58 pounds per ton, 0.28%. The average for 1914 was 2.22 pounds, 0.11%. Thereafter, during 1915 and 1916, with pine oil alone the averages were 1.49 pounds and 1.43 pounds, respectively, both 0.07%.

Sulphuric acid, was used in varying proportions, the highest average during this period of exclusive use of mineral-froth-forming oils being 12 pounds per ton in the year 1914, and the average for the best year, 1916, being 5.25 pounds per ton. The heating was maintained as before (Vol. IV, p. 1965, XQs467, 468). The agitation was increased in vigor and violence with the introduction of the Janney machines, the use of which began early in 1915 (p. 1939, XQs342, 343).

Defendant's Exhibit No. 158 (*supra*) shows 1,598,789 tons of material treated from January 1, 1913, to the end of 1916, with improvement in operations up to the climax year 1916, when the recovery was more than 92% and the grade of concentrate was 53.83% zinc. These operations, to which must be added what was done in 1911 and 1912, the tonnage of which has not yet appeared (five and one-half years in all) are the admittedly infringing operations of the defendant

3. On December 11, 1916, the decision of this Court was rendered. Commencing on December 29, 1916, and continuing until January 8, 1917, mill tests were made on small tonnages (Defendant's Exhibit 163, Vol. VI, original paging 5197, preceding p. 2883) with varying results, principally low grade concentrates, and employing various mixtures (Defendant's Exhibit 164, Vol. VI, p. 2883) of kerosene, so-called Jones crude oil, practically fuel oil, creosotes, pine oil and tar oil. Sixteen variations of mixtures were used, only two including pine oil. An effort was undoubtedly made to avoid further use of pine oil. The amounts of the mixtures used are shown in the column headed—Oil—per ton ore to machines—pounds added (Exhibit 163), and the percentages in the next column, headed—per cent. added. The percentages varied from 0.65% to 2.26% on the ore. As a result of these tests the following changes were made in the *regular mill procedure*, commencing January 9, 1917 (Defendant's Exhibit 159, January; 160 oil chart; 161, February; 162, March; Vol. VI; original paging 5185-5195, following p. 2882):

(a) Defendant doubled the sulphuric acid. In 1916, 5.25 lbs. had been used per ton of ore. This was increased to about 20 lbs. for a week, and then reduced to 13 lbs. or 14 lbs. and finally to about 10 lbs.

(b) Defendant increased the pine oil. In 1916 1.43 lbs. had been used per ton of ore (0.07%). In the 19 days of January, 1917, when used at all, 1.51 lbs. were used on the average per ton of ore (.075%); in February, 1.90 lbs. (.095%), and in March 2.82 lbs. (.141%). These figures are actual and are ob-

tained by calculation from Exhibits 159-162. For example, the oil mixture used on January 31, 1917, was No. 18 (Exhibit 159, last column). No. 18 contained 10% of pine oil (Exhibit 160). The total oil mixture added per ton of ore on this day was 12.63 lbs. 10% of that is 1.263 lbs., which is 0.063% on the ore. So each day was calculated and the average taken.

(c) Defendant added kerosene or fuel oil (or the fuel oil equivalents Jones crude oil or paraffine base oil) or mixtures thereof, aggregating on the average 11.93 lbs. in January, 1917, 16.25 lbs. in February and 18.77 lbs. in March per ton of ore.

The figures given in (b) and (c) disregard the creosotes and other ingredients used, but these constituted approximately only 10% of the whole in January, 5% in February and 2% in March.*

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*Defendant has made it difficult to reach these separate values given in (b) and (c) above by its method of stating in Exhibits 158, 159, 161 and 162 only one figure for the total oil mixtures added, including under that term kerosene, Jones crude, No. 1 creosote, No. 2 creosote, Fuel, Pine, No. 4 Barrett, Tar and Paraffine base. The ingredients and percentage of each mixture for each day are given however in Exhibit 160 (original paging 5189) and these percentages have to be figured on the total "Pounds Added" of the other exhibits. The above figures were obtained in that way. The figures given by Dosenbach as "the best illustration of the procedure at the mill" (Vol. IV, pp. 1915, 1916, Qs136, 137), namely, 30 lbs. of total oil mixture (1.5% on the ore) of which 5.40 lbs. was pine oil (.27% on the ore) and 24.60 lbs. was petroleum products; also the total of 26 lbs. (1.3% on the ore) of oil mixture used in defendant's mill demonstration made for petitioners during the trial, on April 29, 1917, of which 6.24 lbs. was pine oil (.312% on the ore) and 19.76 lbs. was petroleum products (Vol. V, p. 2457, Q22); also the total of 42 lbs. (2.11% on the ore) of oil mixture used on May 5, 1917, in the Exhibit Model Pyramid machine of which 7.56 lbs. was pine oil (.378% on the ore) and 34.44 lbs. was petroleum products (Vol. IV, pp. 2191-2193, RQs178-187)—all of these figures are seen by the actual figures given of the real mill operations (Exs. 158, 159, 161 and 162) to be altogether too high in both factors.

These latter Exhibits disclose almost daily variations of ingredients and of percentages and of totals. Thus the total oil mixture added per ton of ore varied in January, 1917 (Exhibit 159) from 8.06 lbs. to 22.55 lbs. and averaged 14.75 lbs.; in February (Exhibit 161) from 10.77 lbs. to 24.86 lbs. and averaged 19.33 lbs.; in March (Exhibit 162) from 17.52 lbs. to 29.44 and averaged 22.08 lbs.; and in April 1-15 (Exhibit 158) averaged 23.91 lbs., but the particulars as to oil mixtures are not given. This covers all of defendant's operations from January 9 to April 15, 1917, and shows that neither 42 lbs. nor 30 lbs. nor 26 lbs. were typical of the total mixture added in the real mill operations. Nor were 7.56 lbs., nor 6.24 lbs., nor 5.40 lbs. typical of the amount of pine oil used in the actual mill operations.

The District Court adopted the larger figures given by defendant's witnesses, the ones most favorable to it, and still found infringement.

The following table states the changes in oil proportions, as given in or computable from defendant's detailed tabular exhibits, first for the year 1916, and then for the later periods of which the details are proved:

	Pine Oil		Petroleums	Total	
	Lbs.	%	Lbs.	Lbs.	%
Jan.-Dec., 1916.....	1.43	.07	0	1.43	.07
Jan. 9-31, 1917.....	1.51	.075	11.93	14.75	.738
Feb. 1-28	1.90	.095	16.25	19.33	.967
Mch. 1-31	2.82	.141	18.77	22.08	1.11

Additionally to the regular mill operations in 1917, carried on over a period of months, and summed up above, there were operations just before the trial and during the trial which indicated overanxiety of the defendant to show its ability to use a larger amount of oil. The April 1 to 15 operations, of which no details were given, are probably in that category, only the total average amount of oil appearing (Exhibit 158), as 23.91 pounds or 1.19%.

The figures are of oil added, which is the oil used, and disregard the figures as to "oil in ore and circulating middlings" which commence to appear in Exhibit 158, in February, 1917, when defendant was unable to run its flotation plant at 20 pounds or more to the ton and sought some pretense to magnify the figures. This subject is considered under "Circulating Middlings" (*infra*, pp. 123-127).

A small amount of sulphate of copper is used by defendant for its chemical action in preventing the evolution of sulphuretted hydrogen which would impair or defeat bubble formation (Higgins, Vol. V, pp. 2613, 2614, Qs59-61). This is a peculiarity of defendant's ore. The use of copper sulphate has continued ever since July, 1915 (Dosenbach, Vol. IV, p. 1966, Qs472, 473). It may be disregarded on the question of infringement.

On January 29, 1917, during the trial, petitioners' representatives inspected defendant's mill and saw the defendant's

operation of the process as then carried on. At this time defendant succeeded in using its oil mixture at the rate of 26.02 lbs. per ton (Vol. VI, p. 2936), 1.3% on the ore. This mixture contained 17 lbs. to the ton of fuel oil, 0.85%, 2.96 lbs. per ton of kerosene, 0.15%, and 6.41 lbs. per ton of pine oil, 0.32%. The inactive petroleum oils aggregated one per cent. on the ore, and to this was added a small fraction of one per cent., 0.32%, of the active oil, pine oil, which actually did the work, but in maximum quantity to cope with the excessive amount of inactive oils.

At this inspection, therefore, the addition of inactive oils was at the maximum, and the identification of the operations by inspection, by the appearance of the overflowing mineral froth, was an identification in extreme conditions of attempted disguise of the operations of the process in suit.

Various expedients were found to be in operation to cope with the unusually large amounts of ineffective oil. They were as follows:

1. The ore treated contained a large and abnormal proportion of clay gangue which absorbed oil and made it useless in the process, and accounted for part of the oil.

2. A highly valuable product, containing 8.65% of zinc (173 pounds to the ton) was allowed to run to waste.

3. The oil mixture was heated and then flowed into cold pulp, where a portion of the inactive fuel oil solidified into grease, and was discovered in the tailings or waste discharged from the operations in the form of little nodules or granules of grease. This grease was useless in the process and accounted for part of the oil.

These expedients probably did not characterize all of defendant's operations with ineffective oils. Mr. Dosenbach testifies that in these operations the pulp temperatures varied from 34° to 40° Centigrade (57° to 104° Fahrenheit) (Vol. IV, p. 2186, XQs143, 144). Apparently the cold-pulp grease-

producing conditions were only necessary with maximum amounts of these oils.

In the exhibited operations of the 26.37 pounds of oil used, an aggregate of more than 10 pounds ran to waste in the tailings, as computable from defendant's determination of the oil in the tailings, "General Mill Tails" (Vol. VI, p. 2939).

The evidence of petitioners' observers as to the presence of an unusually large amount of oil-absorptive clay in the ore, and that the oil thus absorbed is lost to the process is uncontradicted (Chapman, Vol. V, p. 2458, Qs25-29, p. 2461, Q52; Greninger, p. 2406, Q23; p. 2407, Qs31, 32).

The evidence of petitioners' observers as to the cold-pulp grease-producing conditions, and that this grease was lost to the process, is also uncontradicted (Chapman, Vol. V, pp. 2457, 2458, Q22; p. 2460, Qs41-43; Greninger, p. 2406, Q23; pp. 2407, 2408, Qs35-44).

The discovery of the flowing to waste of a highly valuable product containing 173 pounds of zinc to the ton was not made at the inspection. The flow sheets furnished to petitioners' observers, Defendant's Exhibit No. 165 (Vol. VI, pp. 2884, 2885) (Higgins, Vol. V, p. 2609, Q17), does not show it, and it was not possible to trace it in defendant's mill (Q21). A proper flow sheet of the arrangement at the time of the inspection was later put in evidence (Defendant's Exhibit No. 222, Vol. VI, pp. 2928, 2929), and described (Dosenbach, Vol. IV, p. 2177, XQ38 et seq.). Mr. Chapman discovered it when, on the stand his attention was called to this last mentioned flow sheet (Vol. V, p. 2459, Qs31-33) and expressed his amazement (pp. 2467, 2468, XQs102, 103). Defendant's assays showed the value of the product running to waste, 2nd Cleaner Tails, 8.65% zinc (Vol. VI, p. 2939). Mr. Higgins testified that there must have been (Vol. V, p. 2609, Q22).

> "some grave reason for turning out values of that grade, probably due to the fact that they wished to get rid of some deleterious material at that point."

The apparatus used by defendant is shown in Defendant's Exhibit No. 222 (Vol. VI, pp. 2928, 2929). There are eight sets of the Janney machines heretofore described (*supra*, pp. 82, 83), each set having seven successive machines in series. In each series the first three are mechanical machines, the last four mechanical-air machines with pneumatic equipment (Dosenbach, Vol. IV, p. 2178, XQs42-44; p. 2179, XQ58). At the tail end of the system there are fourteen air cells or Callow pneumatic machines (p. 1897). Thus the operations give all the varieties of agitation and froth flotation that have been used in the practice of the process in suit, (1) agitation in an agitation chamber followed by froth-separation in a spitzkasten, (2) the same, but with air-agitation superadded in the spitzkasten, (3) air-agitation and froth separation in a pneumatic cell, as practiced by the defendant in the Miami suit. The Callow pneumatic cells were installed in the latter part of 1915 (Dosenbach, Vol. IV, p. 1971, XQ536). Janney machines were installed in 1915 (p. 1939, XQs342, 343), but were replaced during the period of change by ineffective oil additions by the present Janney pyramid machines (p. 1940, XQs345-347), which include the mechanical-air machines, with pneumatic equipment in the spitzkastens. This seems to have been the only change in machinery acompanying the addition of ineffective oils. Mr. Dosenbach testifies that no change was made in the time or degree of agitation (p. 1977, RQ614).

All changes of procedure accompanying the addition to a small fraction of one per cent. of effective oil, of a larger amount of ineffective oil, have now been considered. Do these changes achieve non-infringement?

1. *The Discontinuance of the Use of Oleic Acid in December, 1914.*

This can only affect the question of infringement of claims 5, 6 and 7, which call specifically for oleic acid. Those claims have not been infringed since that time.

2. *The Addition of an Extra Quantity of Sulphuric Acid to the Pulp, 10 Lbs. Per Ton of Ore Instead of 5.25 Lbs.*

The necessity for the doubling of the acid evidences a greater tendency of the gangue to be coated with oil, for according to the patent (p. 1, line 41) the effect of acidity is "to prevent gangue from being coated with oily substance, or, in other words, to render the selective action of the oil more marked". The increase in the quantity of acid, therefore, would seem to be calculated not to change the process but to preserve it from change.

3. *The Addition of an Extra Quantity of Pine Oil*—1.51 *Lbs. Per Ton of Ore in January,* 1917 (0.075%), 1.90 *Lbs. in February* (0.095%) *and* 2.82 *Lbs. in March* (0.14%) *Instead of the* 1.43 *Lbs. Used in* 1916 (0.07%).

This larger amount is well within the narrowest prescription of the patent, even when its soluble constituent is unsubtracted and disregarded. It is undoubtedly "considerably reduced" (p. 1, line 29) as compared to Cattermole proportions, and is reduced "say to a fraction of one per cent. on the ore" (p. 1, line 30), and is but little away from the "0.1 per cent. of the ore" which is given as the recommended proportion in the case of oleic acid and Broken Hill ore (p. 1, line 99). It is well within the terms of all the claims even on the narrowest construction—"a fraction of one per cent. on the ore" of claims 1, 2, 3 and 12—"a small quantity" of claims 9, 10 and 11 as limited by disclaimer. When the soluble constituent (which is dissolved out of the pine oil at once by the water of the pulp) is considered and subtracted the oil residue left to effect the process in suit must be less in quantity than the small quantities given.

Does the slightly larger quantity of pine oil operate in the process since January 9, 1917, any differently than the smaller quantity did before that time? No testimony for defendant shows that it operates any differently and no testimony even tends in that direction. On the contrary the experts on both sides agree that the same operation proceeds and the same mineral-carrying froth concentrate is produced, and defend-

ant's witnesses give no different explanation of its formation, and there is none.

The fact that after experimental efforts to do without pine oil its use had to be resumed indicates the essential character of its function in the process.

The fact that, coincidently with the addition of the excess quantity of petroleum products the quantity of pine oil had to be increased indicates that the fulfilling of its function in the process was rendered harder by the presence of the petroleum products. The function of the oil of the patent being to modify the air bubble formation and the adherence of "such bubbles or air films" "to the mineral particles" and thereby to effectuate the peculiar mineral-carrying froth phenomenon and result (Patent, p. 1, line 89, p. 2, line 111, p. 3, line 27), the inference to be drawn from the necessity of increasing the quantity of pine oil is, that the petroleum products, as used, tend to hinder and prevent that function.

The increase in the quantity of pine oil, therefore, would seem to be calculated not to change the process but to preserve it from change.

4. *The Addition of Kerosene or of Fuel Oil or Equivalents, or of Mixtures Thereof in an Average Aggregate in January,* 1917, *of* 11.93 *Lbs., in February of* 16.25 *Lbs., and in March of* 18.77 *Lbs. Per Ton of Ore.*

The testimony on the question whether this addition of petroleum products changes the character or the substance of the operation or the kind or nature of the result or product is as follows:

Petitioners' testimony shows, by Mr. Greninger (accepting the mill procedure of April 29, 1917, as illustrative of the process) that the overflowing froth of defendant's 1917 process, as it overflowed from the first spitzkasten of each machine, under the conditions where no oil had been ejected from the system, was a "typical mineral froth of the patent in suit." He says (Vol. V, p. 2405, Q14):

"The concentrate was a mineral froth, I would say a typical froth of the patent in suit, with indications of a degree of over-oiling, the degree of over-oiling did not seem so marked as I would have expected knowing the condition of oiling at that time and knowing the amount of oil being introduced into the plant."

He describes the mineral froth overflowing in successive spitzkastens (Qs17, 18) and says that the process is the process of the patent in suit (pp. 2405, 2406, Qs19, 20); that the result is the same (Q21) though inferior (Q22); that a large proportion of the oil of the mixture was an inactive oil and useless for flotation purposes when used alone (pp. 2420, 2421, Qs189-194); that much of it was absorbed by the clay slime of the gangue (p. 2407, Qs32, 33).

Mr. Chapman testified on the same subject, beginning at Vol. V, p. 2457, Q21. He says that the process is the agitation froth process (p. 2459, Q37); that fuel oil, kerosene and stove oil are inactive in defendant's process (Qs38-40), although in small quantities they sometimes help steady the froth overflow; he noted an unusually large proportion of clay gangue slime in the defendant's pulp (p. 2458, Q25), and says that this absorbs oil and renders it inactive for flotation purposes (Qs27-29; p. 2467, XQs95, 96); he says that the agitation was greater than in petitioners' standard practice (p. 2464, Q72).

Mr. Higgins testifies that the defendant's process as exemplified on April 29 was not the process of Everson, Kirby, Froment or the California Journal (Vol. V, p. 2612, Q43, et seq., p. 2634, RQ249); that it was the process of the patent in suit (p. 2610, Qs34-36), and that it was also the process of the soluble frothing agent patent (p. 2611, Qs37, 38); that kerosene used alone is ineffective for flotation (p. 2613, Q49); and is not a mineral-frothing agent (p. 2544, Q407); and he demonstrated that fact by a court test employing 2 lbs. kerosene (0.1%) per ton of ore (Qs407-416). He then added 2 lbs. of pine oil per ton of ore (0.1%) and repeated the agita-

tion and a good mineral froth was produced (Qs416-419). He testified that kerosene when used *in small quantities* with pine oil

> "stabilizes the froth and prevents what we call showering, that is, the dropping out of the coarser particles from the froth" (p. 2545, Q422);

and he also testified that a mixture of fuel oil and kerosene is not effective, "does not make a froth" (p. 2545, Q423), and demonstrated that these components of defendant's mixture, aggregating 18 lbs. to the ton, would not produce a mineral froth, but that when 4 lbs. of pine oil was added and the agitation repeated a good mineral froth was produced (p. 2545, Qs424-426; p. 2548, Qs444-447; pp. 2549, 2550, Qs458-466).

Mr. Wiggin of the Anaconda Co. says some of the petroleum oils do not produce the result aimed at in flotation (Vol. V, p. 2400, XQs98, 99); that he never considered stove oil a flotation oil (XQ106); that stove oil seems to make the froth a little more compact (p. 2384, par. 2); that aluminous clay material in the Anaconda copper slime probably absorbs some oil, rendering that much of the oil useless for flotation (p. 2392, Q33).

Some of defendant's witnesses attempted to prove sporadic operation with kerosene or fuel oil, but they were thoroughly discredited. (See cross-examination of Janney, Vol. III, pp. 1545-1551, XQs349-408, and pp. 1553, 1554, RQs432-446).

Defendant's witness, Mr. Englemann of the Ray Consolidated Co. says of fuel oil that which constitutes about 70% of appellant's mixture,

> "we tried at different times to run on straight fuel oil, but we could never maintain metallurgical results" (Vol. IV, p. 1871, Q78).

Professor Bancroft, testifying for defendant, repeatedly says that kerosene is a non-frothing oil, and selects it as the

typical non-frothing oil (Vol. IV, p. 1816, Q24; p. 1820, Qs50, 51) and refers to defendant's mixture used on April 29 as containing (1) the non-frothing viscous oil, fuel oil, (2) kerosene, which he had selected as the typical non-frothing oil, and (3) pine oil, a frothing oil (p. 1818, Qs40, 41).

Dr. Sadtler, for defendant, admits that in his experience some kerosenes cannot be made to raise a froth, although he further says that other kerosenes do, but he cannot say why (Vol. V, p. 2638, Q6).

Professor Taggart, testifying for defendant, said that the oil that is not taken up by the bubble surfaces but on the contrary floats as oil, is

> "lost to the process" (Vol. IV, p. 1756, Q248);

also that the oil that comes to the surface as oil and flows over with the concentrate is wasted (*ib.*).

Professor Beach, testifying for defendant, says that there is no difference in the function when the oil is over one per cent. and when it is under one per cent. (Vol. IV, p. 1778, Q55) and that the process is the same in kind whether oil above one per cent. or oil under one per cent. is used (pp. 1804, 1805, XQs228, 229).

Petitioners' witnesses had spoken of the large absorption of the fuel oil and kerosene in the clay gangue slime of the ore. The reports of defendant's mill superintendent (Defendant's Exhibit 227, Vol. VI, p. 2939) show that of every 26.37 lbs. of oil added on April 29, more than 10 lbs. ran to waste in the tailings.

That defendant's 1917 procedure is metallurgically and financially inferior to its former procedure has been admitted by defendant's counsel. It is so clearly proved that denial would be futile.

Mr. Wilding in Vol. V, p. 2564, Q136, et seq., and in Plaintiff's Exhibit 272 (Vol. VI, original paging 5437, facing p. 3022) institutes a comparison between the last quarter of

1916 and the first quarter of 1917 based upon the defendant's own figures given in its monthly statements filed in court, these periods being chosen as the nearest together in point of time and therefore the closest approximations to each other in the matter of mill development in process and machinery. The results briefly tabulated are as follows:

	1916	1917
Zinc recovery	92.94%	83.11%
Zinc in concentrate	53.25%	47.23%
Zinc in tailings	1.24%	2.79%
Zinc lost per ton of ore	19.11 lbs.	43.22 lbs.
Concentration cost per ton of ore...	$0.82	$1.34

Thus the 1917 procedure as compared with that of 1916 lost more of the values in the tailings, failed to achieve as high a grade of concentrate for the smelter, and cost more in the mill. It cost more to achieve less.

Mr. Wilding made a further comparison of the separate months of 1917 with selected months of 1916 when the grade of ore ran about the same, and as a final conclusion of this comparison (Vol. V, p. 2573, Q256-258, and note on Plaintiff's Exhibit 273, Vol. VI, original paging 5439) said that the figures show that there was a decrease of profit in 1917 from the zinc alone of about $1.75 per ton on every ton of ore delivered to the flotation plant, and that the capacity of the mill was reduced, and that on a conservative estimate as to the market price of spelter, the decrease of profit on 580,000 tons, being about one year's capacity, would be upwards of $1,000,000. And this defendant's counsel admitted and used in their argument of non-infringement (see Main Brief, pp. 25, 26).

Mr. Wilkinson (Vol. V, p. 2578 et seq., and Exhibit 275, Vol. VI, original paging 5443), approaching the matter from a slightly different angle compared the defendant's figures for its flotation of zinc ore during the first quarter of 1917 as given in its sworn monthly reports, with the Timber-Butte

mill figures for the same quarter for its flotation of the similar Elm Orlu ore as given in Plaintiff's Exhibit 249 (Vol. VI, p. 2980), Timber Butte Mill being that of one of petitioners' licensees. The result was as follows:

	Timber-Butte Mill	Defendant's Mill
Zinc recovery	97.72%	83.11%
Zinc in concentrate	55.47%	47.23%
Zinc in tailing	0.44%	2.79%

Mr. Wilkinson gives it as his opinion that the result obtained at the Timber-Butte mill as given is considerably better, indeed notably better, than the result obtained at the defendant's mill (Vol. V, p. 2583, Qs43-48).

The comment of the District Court on this testimony was (Vol. 1, p. 100):

> "Defendant not very insistently claims results for this latter period are more profitable than for the former, but plaintiffs' analysis, neither denied nor criticized, and beyond both, of defendant's reports and tabulations makes manifest the fact is otherwise to the extent of about $1.75 per ton of ore—an enormous loss on 45,000 tons monthly. There is considerable like testimony in reference to operations by other infringers."

Summing up all the testimony as to defendant's 1917 procedure, the facts stated and the opinions given of practical experts in this art and the calculations based on defendant's own reports stand uncontradicted, and furnish full basis and justification for the findings of the District Court in this regard.

It is a patent fact that it was no metallurgical necessity or advantage that prompted defendant's increase in the amount of oils since January 9, 1917. It is a patent fact that it was the decision of this Court upholding the patent as valid, that prompted, and alone explains, that metallurgically absurd and

financially ridiculous action. It is a patent fact that defendant by that action sought to just squeeze over the line that it thought marked the boundary of petitioners' monopoly—to just squeeze over the line and no more, so as to retain as much of the substance and advantage as possible, and yet appear to be outside the terms of the claims—to stay so near as to keep the substance while seeming to avoid the letter. It is a patent fact that defendant's action was "obviously intended to avoid the wording of the claims" (*Hoyt* vs. *Horne,* 145 U. S., 302, 309); that it was "not to bring about a product essentially different from the patented product, but to introduce a process so colorably different that it might be used as a shelter against the charge of infringement" (*National Co.* vs. *Elkhart,* 123 Fed., 431, 433)—*a situation that challenges the ingenuity of a court of equity to defeat it (and properly so) by considering the substance of things rather than the letter.*

The question of infringement by defendant's recent practice may be considered from the comprehensive point of view of the process as a whole, or it may be considered from the point of view of each step separately, that is to say, the action of each agitator cell and spitzkasten unit by itself. From either point of view infringement is equally manifest.

From the point of view of the general process, that part of the oil mixture which constitutes the greater part and which carries the total about twenty pounds, is useless and ineffective for the purposes of flotation; it is not certain that with the character of ore that defendant now treats it, this ineffective oil actually exercises a preferential affinity for the metal over gangue, since it seems to go indiscriminately to both; and under the conditions of its use it is prevented from assisting, and also largely prevented from defeating, the real process that is proceeding by the presence of a small fraction of one per cent. of effective oil, by the presence also of a soluble frothing agent and by the terrific agitation employed. The general process is proceeding by reason of the presence of the small fraction of one per cent. of effective oil, and in spite of

the presence of the large fraction of one per cent. of ineffective oil. The oils of the mixture have been carefully selected for these respective purposes, and as the result, as Mr. Dosenbach says, of an accidental discovery made by him in 1913 that there were such ineffective oils that could be used in mixtures or which were themselves mixtures of effective and ineffective oils in excessive quantities without defeating the main process (Vol. IV, pp. 1941, 1942, XQs361, 364, p. 1977, RQ610) and he later experimented with thousands of oils (p. 1942, XQ370); and as the result, as Mr. Thomas Janney says, of a protracted experimental investigation carried on through two years or more (Vol. III, p. 1509, Qs12-17), and perhaps the result also of the development and invention of Mr. Janney of a machine giving so violent and so often repeated an agitation, that the blighting and froth-destroying effect of the excess oil is to some extent neutralized and overcome. These young men, after several years of investigation and effort, contrived how to use petitioners' process without, as they thought, appearing to do so. They admittedly get petitioners' results. They undoubtedly carry out the patented process. *Their departure in the matter of the more violent agitation employed is not a departure toward the prior art, but away from the prior art.* And their use of an excessive and useless quantity of ineffective oil is a mere pretense and a sham, is *mere camouflage.* Every element of every claim in issue (except the oleic acid claims) is present in defendant's recent procedure: powdered ore, water, agitation, oil-coated mineral matter, the oil coating being obtained by the addition to the water of an oily liquid that has the capacity to form mineral-froth and amounting to a fraction of one per cent. on the ore, an air-lift of the metal actually proceeding, and an air-froth actually holding the metal, that froth separated from the remainder of the pulp by air flotation, that is to say, by air-lift, and the so-separated froth being then removed. There is no real controversy as to these facts. The further addition of oily liquid that is ineffective to form a mineral-froth and that in fact does not form the

mineral matter into a froth, and that does not contribute to the air-lift of the mineral or to the air-froth holding of the mineral after lifting, but that goes partly to the gangue and partly remains as unattached oil that merely floats uselessly as oil, is wholly immaterial, seeing that it has no practical effect on the result either to achieve that result or to defeat it.

Considered from the more detailed point of view, that is to say, regarded as a series of processes, it is equally clear that defendant's recent operations are an infringement.

Regarding each machine as effectuating a separate process, there are some sixty or seventy such processes in defendant's mill proceeding continuously, either side by side, or successively, as the case may be, according to the flow sheet. Everything that has been said above from the general point of view, applies to each and every machine considered separately, even to the first machine in each set. And in addition *each subsequent machine in each set after the first machine, operates upon a pulp mixture in which the proportion of oil to solid matter constantly diminishes,* and consequently, after the first machine, we have—as the mixture fed to each subsequent machine and agitated there and a mineral-carrying froth taken from it there—a mixture of oil, ore, water and acid, in which the total oil of all kinds is less than one per cent. of the dry weight of the solid matter of the ore fed to that machine at that time.

The tailings of the first cell or machine are the feed of the second and the tailings of the second are the feed of the third and so on down through the seven rougher cells of each pyramid or group. A continuous and in all essentials a complete process of concentration of ore goes in on each cell. But more oil in proportion to solids goes out in each case with the concentrate at the top than is left to go out with the tailings at the bottom. So the feed to the successive cells is impoverished in its percentage of oil to ore by successive steps. If the feed to the first cell has barely over one per cent. of oil the feed to the second cell is bound to be notably less and under one per cent. and the impoverishment is progressive and inevitable and

is notable in amount at each step and all of the operations after the first is bound to be a process conducted with less than one per cent. of oil (of every kind) to ore in its feed. By cell or machine we mean a complete Janney unit including the agitator part and the froth-separating part or spitzkasten. There is no way in which defendant could employ a pyramid of machines, the tailings of one being the feed of the next, that would not by one or two steps so impoverish the feed in the matter of oil that the percentage of total oil to ore in such feed would drop far below one per cent.

Again in the fourth, fifth, sixth and seventh spitzkastens of the rougher machines air under pressure is introduced at the bottom, causing an additional ebullition of bubbles that sweep upward through the pulp, and "to the surface thereof, all the metalliferous matter in the form of a froth" (Patent in suit, p. 2, line 114). In all these rougher machines this additional aeration and the agitation that it achieves and the additional air-lift and air-froth that it produces, follow a mechanical agitation in a separate vessel just as described in the patent in suit, and are applied to the tailings that flow from the spitzkastens of earlier rougher cells, just exactly as it is applied in the patent in suit—a "method for the recovery of any sunk oiled metalliferous matter which may be deposited in the second and third spitzkasten" (Patent in suit, p. 2, line 103). This in itself would be an infringement if there were nothing more.

Again, as a further supplementary treatment for the recovery of any oiled metalliferous matter that may have failed to rise in any of the series of rougher machines, and has consequently been discharged as a tailing from the bottom of the last spitzkasten, those tailings are submitted in a number of Callow cells to a final agitation effected by the introduction of air under pressure through cloth at the bottom of the cells, this again sweeping to the top in the form of a froth any oil-coated metalliferous particles that may have escaped air-lifting theretofore. The very excess and superabundance of air and of air-

froth produced in this way achieves something additional in the way of mineral recovery and so adds to the general effectiveness of the process. Considered with the preceding agitation that the pulp has received, it constitutes what was held in the Miami case to be an infringement. Considered alone, it constitutes infringement, even if there were nothing more, and the bulk of the oil having gone with the concentrate, there must have been in this operation a condition paralleling that arising from the addition to the pulp of a small fraction of one per cent. of oil to solid matter, even counting all the ineffective oil.

Infringement—The Law.

Inventions are things, not words. Infringement goes to substance, not to form. As this Court said in Union Paper Bag Machine Co. vs. Murphy, 97 U. S., 120:

> "if special attention is given to such portion of a given device 'as really does the work,'"

disregarding the parts merely used as conveniences, and thus going through the mask to the reality beneath the mask, the determination of infringement is not difficult.

This Court in the Hyde case has in effect prejudged the question of infringement in the case at bar by laying down the test or rule by which infringement is to be judged, given ore, oil, water, agitation and mineral froth production, namely, by "the results obtained," paralleling the rule "by the test of *beneficial results*" stated in *United States Mitis Co.* vs. *Carnegie Co.*, 89 Fed., 343. There is no controversy as to the fact that the results obtained by the defendant in the way of air-lift and air-froth and ore concentration since January 9. 1917, are the same in kind as the results obtained for the preceding five and a half years.

A defendant cannot avoid the charge of infringement by sailing so close to the limitations of the patent (even assuming that the patent were in fact to be so limited) as to get

substantially all the beneficial results while avoiding only the letter. The rule stated in *Westinghouse* vs. *Boyden* disposes of this contention (*infra*, p. 122).

If "all of the *efficient* elements of the combination are retained, or their places supplied by well-known equivalents," and if the "organization is essentially the same," there is infringement (*O'Reilly* vs. *Morse*, 15 How., 62).

A fundamental inquiry is, has the defendant got the novel result and if so how does he get it (*Columbia Works* vs. *Rutherford*, 58 Fed., 787).

In *Winans* vs. *Denmead*, 15 How., 343, this Court said:

> "It is the duty of courts and juries to look through the form for the substance of the invention—for that which entitled the inventor to his patent, and which the patent was designed to secure; where that is found there is an infringement."

A line of early cases similar on the facts to the instant case are the following:

United Nickel vs. *Harris*, 15 Blatchford, 319; 24 Fed. Cas., 727, 732, is one of a series of cases about a patent for a process of electro-deposition of nickel in a solution free from potash and soda and also free from acid. The defendant added small quantities of sulphate or chloride of potash or soda. The plaintiff claimed that this substance was inert, being in the chemical state of a sulphate or a chloride that did not result in the presence of free potash or soda. The Court said:

> "If the introduction of such sulphates or chlorides is otherwise of any benefit, their use is but an improvement, and the invention of the patentee is availed of, notwithstanding its introduction."

United Nickel vs. *Pendleton*, 15 Fed., 739; 24 Fed. Cas., 732. This related to the same patent. Here the defendant put in some free acetic acid, and the Court had great difficulty in de-

ciding as to infringement because the claims said expressly that there must be no free acid; free acetic acid hindered the main process a little, but did not prevent it absolutely, and did something else that was helpful. Judge, afterward Justice, Blatchford, an able patent judge, held that that mixture, although it violated the letter of the claim, was an equivalent of the mixture of the claim, and an infringement.

These were the claims of the Adams patent:

> "1. The electro-deposition of nickel by means of a solution of the double sulphate of nickel and ammonia, or a solution of the double chloride of nickel and ammonium, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime, or nitric acid, or from any acid or alkaline reaction. 4. The electroplating of metals with a coating of compact, coherent, tenacious, flexible nickel of sufficient thickness to protect the metal upon which the deposit is made from the action of corrosive agents with which the article may be brought in contact" (p. 740).

Judge Blatchford cited previous decisions on this same patent as follows:

> "In the Keith case, in February, 1874, the validity of the patent was again sustained, and infringement of claim 1 was adjudged, because of a use, in the electro-deposition of nickel, of a solution of the double sulphate of nickel and ammonia, although such solution contained a small proportion of tartrate of ammonia, and a small proportion of ammonia, the first of these being an inert substance in the solution and the second being speedily eliminated by evaporation when the solution was used.
>
> "In the Harris case in October, 1878, the patent was held valid. Claim 1 was held to be a claim to the electro-deposition of nickel by means of any solution of the double sulphate of nickel and ammonia, or of any solution of the double chloride of nickel and ammonium, however such solution may be prepared, provided such solution is so used as to be free, while the electro-deposition of nickel is

going on, from the presence of potash, soda, alumina, lime, or nitric acid, or from any acid or alkaline reaction. Infringement of that claim was adjudged, and it was held that, although a sulphate or chloride of potash or soda might be introduced into either of the named solutions, yet, if the solution was so used, in the electro-deposition of nickel, that the sulphate or the chloride would not be decomposed, the claim was infringed * * * (p. 741).

"In the Manhattan Brass Case in March, 1879, infringement of claim 1 was adjudged, and it was held that that claim was infringed, although the salts of potash and soda were introduced into the solution, provided the solution was not so used as to liberate free potash or free soda" (p. 741).

Now, in this last case (the Pendleton case), which came before Judge Blatchford, the facts were that the defendant had added an acetate of nickel solution, and an excess of acetic acid. Said Judge Blatchford (p. 743):

"The evidence shows that a pure acetate of nickel, used without an excess of acetic acid, will, under proper conditions of strength of current and strength of solution, produce such a reguline deposit of nickel as Adams' patent contemplates, and that the absence of any acid or alkaline reaction in the acetate produces the best results, especially as to the quantity of metal deposited with a given battery power in a given time. An excess of acetic acid impairs the efficiency of the solution. It is shown that the presence of an acid reaction, by turning litmus paper red, by no means indicates the presence of free acid, so as to make a practically injurious departure from neutrality, in the direction of acid reaction. On the other hand, it appears that an excess of acetic acid has the effect to neutralize the deleterious properties of such alkaline substances as soda, potash and lime, which, if finding their way into the solution, will injure the quality of the deposit. * * *

"At the time of Adams' invention it was known that the addition of a slight excess of acid to a simple salt of nickel would prevent the deposit of oxide of nickel upon the cathode, by taking up the oxide, and thus act in the same

manner as ammonia salts, in the solutions of the Adams' patent. Under the foregoing premises, as a simple acetate will produce a greater deposit of nickel for the same amount of current in a given time than will a simple acetate with a slight excess of acetic acid, and as such slight excess of acetic acid will prevent the injurious deposit of oxide of nickel in case certain alkaline impurities are present, and as that result is accomplished in the same way as by the use of ammonia salts in the solutions of Adams' patent, those solutions and the defendant's solution are equivalent, in nickel-plating, and in their mode of operation and in the character of the deposit.

"The fair reading of the Adams specification is that, in order to obtain the best results, the solution should be as nearly neutral as possible, and should be especially free from acid. The invention of Adams, as shown in his specification, so far as respects sulphuric and hydrochloric acid, was that the presence of such quantities of those acids as would be likely to get into the solutions named in claim 1, in preparing and using them, would prevent any useful result. Infringement of the claim cannot be avoided by introducing such small quantities of any of the injurious substances named by Adams as will produce no practical injurious effect. • • •

"Before Adams, no product possessing the properties described by him as those of his product was known. He introduced a new process, that of claim 1, as well as a new product or manufacture, that of claim 4. In attempts at nickel-plating before, acids had been used which were known solvents of nickel. Adams used those acids to prepare his solution. • • •

"Adams did not invent these solutions of claim 1. He showed how to prepare and use them successfully. The solution is the vehicle whereby the nickel is conveyed from the anode to the cathode, holding in suspension the nickel to be deposited, and supplying the place of the deposited nickel by taking other nickel from the anode. The real invention was in discovering the proper condition for the use of such vehicle, not the particular chemical composition of the vehicle. Any proper vehicle used with those conditions would do the work. • • •

"If claim 1 of the Adams patent claimed the discovery of a new solution, as does claim 1 of the defendant's patent,

the question would be a different one. But the claim is a claim to a new method of using solutions, requiring specified conditions by the absence of specified injurious elements. The defendant uses his solution in the same way, avoiding those injurious elements, and observing the prescribed conditions. • • •

"The case of *Tilghman* vs. *Proctor*, 102 U. S., 707, is an authority for the conclusion that, on the foregoing facts, claim 1 of the Adams patent ought to have the construction above indicated, and that so construed, it is infringed by the defendant. It is a claim for a process which Adams invented. He describes a mode, and the best mode then known, of carrying it out with success. All that the defendant has done is not to vary the process, or its mode of working, or its essential conditions, but to apply a new solution worked in the same way and under the same conditions. It must, therefore, be held that infringement of claim 1 is established."

In *United Nickel Co.* vs. *Central Pac. R. Co.*, 36 Fed., 186 (Ross, C. C., 9th Circ., 1888), the Court, in charging the jury, said that the Adams patent had been held valid by the courts many times, so that the "real injuries will therefore be limited, first, to the question of infringement" (p. 187) and afterwards damages.

Page 188:

"If, therefore, you find from the evidence that defendant used the process described in the first claim, or manufactured the product described in the fourth claim, of the patent, you will find the question of infringement against the defendant.

"Nor can the plaintiff's patent be defeated by evasion—that is to say, by any mere colorable or unsubstantial change in the process or mode of bringing about the same result. Upon this point the language of Mr. Justice Blatchford in a case involving the infringement of the same claims of the same patent now before you, is very instructive. In that case the defendant claimed to have used, in the process of nickel-plating, a solution essentially different from that covered by the Adams patent."

After quoting much that we have quoted above, the Court adds (p. 189):

> "In the light of these instructions, it is for you, gentlemen of the jury, to say from all the evidence in the case, whether the defendant used one of the solutions referred to in the third claim of the patent, or some other solution, the chemical equivalent of it, in the process described in the first claim, or in the manufacture of the product described in the fourth claim of the patent; in other words, whether the alleged infringement has been established against the defendant."

An instructive case is *Perkins Electric Switch Mfg. Co.* vs. *United Electric Const. Co.*, 191 Fed., 366 (C. C. A., 3rd Circ., Gray, Buffington and Lanning, C. Js., opinion by Buffington, C. J.).

Perkins' patent for an incandescent lamp socket held infringed—reversing the Circuit Court.

The Court said (p. 368):

> "It follows, therefore, that closure or non-closure of the abutting chambers in respondent's device at the place where it is left open is a negligible, functionless matter. * * * Having, by virtue of this recessed location of the switch and the solid wall across the current path made the two chambers electrically insulate, does the respondent become a non-infringer by breaking down the wall at a point beyond, where whether it be perforate or imperforate in no way affects the working of the device?
>
> "Assuredly not, unless mere form and functional substance are the same thing. With as much justice could it be said that a ship that was staunch and tight below the water line was leaky because of its scupper holes."

Columbia Wire Co. vs. *Kokomo Steel & Wire Co.*, 143 Fed., 116 (C. C. A., 7th Circ., 1905, Grosscup, Baker and Seaman, C. Js. Opinion by Seaman, C. J.).

Patent held valid and infringed.

Page 122:

"We are of opinion that the means thus transposed in the appellee's machine, if not within the definition of colorable evasions which infringe the patent in any view of its scope, are plain appropriations of the essence of the Bates conception by equivalent means, and infringements of the patent within the well settled rule referred to. All the elements of the patent combination are employed with substantial identity in their use, and departure appears from the letter of the claims only, in the arrangement of these elements, without substantial difference in the principle of operation. The policy and rules of the patent law require that the patentee be protected against such evasions of the wording of a claim in form or non-essential details, when the substance of the invention is thus used and is unmistakably shown in the specifications and claims." (Winans vs. Denmead, 15 How., 330, 343; 14 L. Ed., 717; 5 Notes U. S. Rep., 331; Ives vs. Hamilton, 92 U. S., 426, 431; 23 L. Ed., 494; Machine Co. vs. Murphy, 97 U. S., 120, 125; 24 L. Ed., 935, and 9 Notes U. S. Rep., 533; Elizabeth vs. Paving Co., 97 U. S., 126, 137; 24 L. Ed., 1000; Hoyt vs. Horne, 145 U. S., 302, 308; 12 Sup. Ct., 922; 36 L. Ed., 713; Westinghouse vs. Boyden Power Brake Co., 170 U. S., 537, 568; 18 Sup. Ct., 707; 42 L. Ed., 1136; International Mfg. Co. vs. H. F. Brammer Mfg. Co. [C. C. A.], 138 Fed., 396, 400.)

* * * * * * * * * *

Page 123:

"The remaining contention, that the appellee's device escapes infringement through its additional means and function in the automatic regulation of tension, does not impress us as tenable, * * * This is a mere addition to the patented machine, supplementing the function of one element, without changing the co-operative function of the wheels in their combination. So, assuming that it is an important improvement (which is disputed in the appellant's testimony) and patentable as an improvement, its association with the means of the prior patent is unauthorized without license from such patentee." (Cochrane vs. Deener, 94 U. S., 780, 787; 24 L. Ed., 139; Cantrell vs. Wallick, 117 U. S., 689, 694; 6 Sup. Ct., 970; 29 L. Ed.,

1017; Hoyt vs. Horne, 145 U. S., 302, 309; 12 Sup. Ct., 922; 36 L. Ed., 713; Walker on Patents [3d Ed.], §347).

"The alleged improver may have a valid patent for his new means and is entitled to its exclusive use; but the prior patent equally excludes him from the use of the prior invention, with or without his improvement."

In the case of *Ford* vs. *Tannage Company*, 84 Fed., 644 (C. C. A., 3rd Circ., 1898, Acheson, C. J., and Butler and Kirkpatrick, D. J. Opinion by Kirkpatrick, D. J.), the patent was for a process of tawing hides by a bath of chrome salts followed by a bath evolving sulphurous acid, and the result was leather. The defendant used a bath of alum salt and chrome salt, followed by a bath evolving sulphurous acid, and the result was leather. Now a bath of alum salt, followed by a bath evolving sulphurous acid, would not produce leather. The Court found, as a fact, that the addition of the alum salt by the defendant did not prevent the action of the chrome salt and that the result was chrome-tawed leather just the same, and held that the mere addition did not avoid infringement. The Court said (p. 646):

"it is clearly shown that the addition of the sulphate of alumina to the bath does not prevent the thorough absorption by the hide or skin of the bichromate of potash";

So here, the addition of the ineffective petroleum oils and the fact that some of the pine oil is dissolved in the water, and that much of the petroleum oil is absorbed in the clay of the gangue slime, and that some of it flows off uselessly as oil, does not prevent the main process from proceeding by the co-action of a fraction of one per cent. of active froth-forming and froth-modifying oil with the agitation to produce modified air bubbles that separate and lift the mineral particles and hold them mechanically suspended in the bubble films of an air-froth.

Washer Company vs. *Cramer*, 169 Fed., 629 (3rd C. C. A., opinion by Gray, C. J.), is another example of *addition* not

avoiding infringement. In that case a spring driving-handle moved a washtub back and forth, the flexibility of the handle cushioning the blow. The defendant put a fixed cushioning spring at each end of the travel of the handle, and used a handle that was only a little bit flexible, but the Court said (pp. 633-634):

> "These cushioning springs were a mere addition to the complete structure of the complainant's device. They supplemented the cushioning function of the driving spring, but did not dispense with it. The defendants do not substitute anything for the patented device, but employ it in its entirety, and then merely add elements, which, without destroying its functions, supplement or partake of them."

In the *National Newsboard Company* vs. *Elkhart*, 123 Fed., 431 (C. C. A., 7th Circ., Jenkins and Grosscup, C. Js., and Bunn, D. J., Opinion by Grosscup, C. J.), the patent was for grinding up old newspapers for pasteboard, the old ink being retained and that being the novelty. It had been the practice to bleach the old ink off by a bleaching agent and then use the product for pasteboard, using ten or twenty per cent. of an alkali in hot water for the bleaching operation. The defendant there used one per cent. of alkali in cold water and of course contended that it was using the process of the prior art. But the Court held that the defendant had infringed (p. 433).

> "But there was no attempt at bleaching after the boiling and the alkali was insufficient to remove but little of the oils. Plainly the removal of the oils was not intended. The whole testimony impresses us with the belief that the introduction of the soda ash was intended, not to bring about a product essentially different from the patented product, but to interpose a process so colorably different that it might be used as a shelter against the charge of infringement."

And so it is here, because there is no possible reason or excuse in metallurgy or in common sense for this defendant

to add in the mixing tank 12 to 18 pounds of a wholly unnecessary and ineffective oil when it can do better work and make more money and have a more efficient concentration by using only the effective frothing oil (which its mixture of course includes) in an amount much less than one per cent. on the ore.

Cowles vs. *Lowrey,* 79 Fed., 331, is an example of a primary invention; a patent broadly construed; and an addition not avoiding infringement.

So *Goodwin* vs. *Eastman,* 213 Fed., 231, a chemical case somewhat like this one; a pioneer patent; a broad construction.

Another line of authorities is what is called "the rule" of *Westinghouse* vs. *Boyden,* 170 U. S., 537, 568. The rule stated there, and said there to have been repeatedly held by this Court (although it did not find application to the facts of that case), is that:

> "a charge of infringement is sometimes made out, though the letter of the claims be avoided."

That is to say, even though the letter of petitioners' claim were limited to the addition in the mixing tank of a total of less than one per cent. of oil, active or inactive, frothing or non-frothing, beneficially used or mostly wasted, the charge of infringement might be made out even though a total of more than one per cent. of oil were added in the mixing tank. It would still remain to be determined whether an equivalent thing had not been done, whether the substance of the invention had not been taken.

Thus in *Topliff* vs. *Topliff,* 145 U. S., 156, 171, Mr. Justice Brown says:

> "the object of the patent law is to secure to inventors a monopoly of what they have actually invented or discovered, and it ought not to be defeated by a too strict and technical adherence to the letter of the statute, or by the application of artificial rules of interpretation."

In *Turrill* vs. *R. R. Co.,* 1 Wall., 491, 510, it is said:

"Patents for inventions are not to be treated as mere monopolies, and, therefore, odious in the eyes of the law; but they are to receive a liberal construction, and under the fair application of the rule, *ut res magis valeat quam pereat,* are, if practicable, to be so interpreted as to uphold and not to destroy the right of the inventor."

In *Hoyt* vs. *Horne,* 145 U. S., 302, the patent was for a rag machine in which the pulp circulated, so said the claim, in vertical planes and also was delivered into an upper section of the vat. Now the defendant did not circulate it in vertical planes but in horizontal planes. He did not deliver it into the upper part of the vat but into the lower part. But the Court held that what he did constituted the substance of the operation and infringed; and, says the Court (p. 309), the device was "obviously intended to evade the wording of the claims."

Underfeed Stoker vs. *Sanford,* 215 Fed., 392, is a good example of a departure from the letter of a claim being held not a departure from the substance. The claim included an air chamber "beneath the retort." The defendant bricked up that air chamber and wholly eliminated its useless function but achieved its useful function by making an outside air chamber contacting with parts of the sides of the retort that needed cooling but not "beneath the retort" and so kept the essential function, and he was held to infringe.

Circulating Middlings.

Three or four of the defendant's witnesses, connected with the defendant and the allied companies of the Jackling group, in presenting their facts and figures as to oil wasting operations have for the first time in their practice and experience and evidently as a new idea, and in most instances after failure to run their mills with 20 pounds or more of oil to the ton of ore, had the returned middlings (concentrates of such low grade that they need retreatment and are returned for that

purpose) analyzed for oil and have added that oil in their calculations and on their exhibits to the feed of new oil on the theory that it is just so much oil introduced to the head of the machine; and in this way apparently they hope to persuade the Court that when they are actually using only 14 or 15 pounds of oil they are really using 20 pounds or more, or when actually using 7 or 8 pounds they are really using more than 10 pounds. But the testimony of all the practical men produced for the petitioners has shattered this theory and quite apart from that a brief consideration will show its fallacy.

These middlings are low grade concentrates which have been through the process but which require improvement in grade by retreatment in the process before they are ready for delivery as finished concentrates. The analyses of the oil in these middings show the total oil quantity irrespective of condition. The oil in the middlings may be in the condition of a coating upon the metallic particles. All the metallic particles in the middlings should be thus coated. The oil in the middlings at defendant's mill may be largely or wholly absorbed already in the clay gangue slimes that are largely present in the middlings and useless for the purposes of the process. It may exist in the returned middlings as minute particles of semi-solid grease, each particle effectively enveloped with water and useless for the process. It may exist in the form of a water-oil emulsion that would be useless for the purposes of the process. The theory takes no account of these things.

Again, the theory takes no account of the fact that if the returned middlings contain any oil in a condition fit and suitable for effective use in the process, that oil has emerged in that condition from one or other of the spitzkastens at the foot of the machine, which means that it has passed through the machine, that is to say, has passed through the process, without being utilized. Under stable conditions the pouring of usable oil into the head of the machine with the middlings, means the pouring of usable oil out of the foot of the machine

to exactly the same amount. The theory overlooks this fact entirely. It adds the usable oil that flows into the head of the machine, but forgets to subtract the equal amount of usable oil delivered continuously from the foot of the machine. When this fact, however, is understood, it will be seen and realized that the assumption that a steady stream of oil suitable for the purposes of the process flows into the head of the machine all day long with the returned middlings, and is used in the process, includes equally the assumption that that precise amount of oil is flowing out at the foot of that machine in that same condition, and therefore is flowing constantly through the machine in that same condition, that is to say, unutilized. That amount of oil, therefore, might just as well flow down the outside of the machine in a launder and then back with the middlings, and so on continuously.

The process in suit starts with an unoiled ore and water and as the process proceeds the metalliferous mineral particles become coated with oil. Any concentration effected by the process whether the concentrate froth is rich enough in metalliferous mineral to form a finished product or is to be deemed a middling and returned for further treatment, involves substantial increase in oil proportion in this concentrate form as compared with the original of unoiled ore, water and oil. For example, in the experiments performed by Prof. Chandler in the Hyde suit the original proportion of oil to the dry material or ore treated was 0.16%, 3.2 lbs. per ton (0.64 grams to 400 grams), the average proportion of oil to dry material in the middlings was 0.33%, 6.6 lbs. per ton, and the average proportion of oil to dry material in the concentrates was 0.42%, 8.4 lbs. per ton (Vol. I, pp. 186, 187). The oil proportion was more than doubled in the middlings and nearly trebled in the concentrates, but the metalliferous mineral proportion was increased in like ratios. The metalliferous mineral was oil-coated and whenever its proportion was increased the oil proportion was increased. The process was undoubtedly one employing 3.2 pounds of oil to the ton of ore, not either 6.6

lbs. or 8.4 lbs. per ton as in the two products of the process. In the middlings and concentrates *the oil was used oil* attached to the metalliferous mineral, and it would be ridiculous to say that, when you carry this middling back to the point of beginning of the process where new ore and new oil were added, mix it with the new material and put it through the process again, you had thereby increased either the consumption of oil or the use of oil in the process. Yet this is the theory of defendant.

But the testimony absolutely disposes of this absurd contention.

Thus Greninger (Vol. V, p. 2413, Qs97-101) says that this oil theoretically returned in the middlings is never counted as oil supply, that it does not help extraction, that it does not save oil, and that the return of the middlings is only to raise the grade of the middlings.

So Mr. Chapman to the same effect (Vol. V, p. 2460, Q45).

So Mr. Wiggin of the Anaconda Company (Vol. V, pp. 2390, 2391, Qs19-23), who testified, after describing return of middlings to head of machine and the alternative of sending the middlings to a different machine for retreatment or cleaning:

> "Q20. Do you ever take into account the oil contained in the returned middlings in determining the consumption of oil in the process?
>
> A. We do not.
>
> * * * * * * * * * *
>
> Q22. Does that return of middlings result in economy of oil in the total process so far as you have observed?
>
> A. No.
>
> Q23. In the matter of consumption of oil in the total process so far as you have observed, does it make any difference whether middlings are returned to the head of the same machine or are returned [sent] to a cleaner machine?
>
> A. I have observed that it makes no difference."

So also Mr. Rossberg, of the Timber Butte Mill, at Vol. V, p. 2433, Qs103-107.

It repeatedly appears in the testimony that, notwithstanding the presence of large amounts of oil in the middlings, this oil will not carry on the process and when the new feed of oil is discontinued, the work of the process stops (Punchon, Vol. IV, pp. 2165-2167; Sutherland, pp. 2167-2169).

It appears from the testimony of all the mining engineers produced as witnesses by the defendant from the Jackling group of infringers (Dosenbach, the Janneys, Conrads, Wicks and Englemann) and from the exhibit tables which they produce as to the practical operations of their respective companies, that none of them ever prior to late December, 1916, counted in as a part of the oil supply (or even measured or assayed) the oil delivered into the sludge tank as a part of the returned middlings. The idea of doing so seems never to have occurred to any of them until after the decision of this Court in the Hyde case, and in most instances after failure in their efforts to operate their mills at 20 pounds of oil to the ton of ore. Obviously the point is of no importance and only serves to accentuate the difficulties that all of these infringers have met with in their attempts to disguise their processes and to obtain the new results first obtained by the process in suit under conditions such as they hoped would enable them to evade the patent.

The Petroleum Oils Used by Defendant Are Not Mineral-Froth-Forming Oils With Defendant's Ore.

At the outset it should be stated that petitioners do *not* contend that *all petroleum oils are non-mineral-froth-forming oils.* Petrol, the British trade equivalent of gasoline, has been used in the laboratory to form a mineral froth. Mr. Higgins so testified in the Hyde case (Vol. II, p. 1062, Q110; p. 1063; Qs112, 113) and repeated that testimony in the instant case (Vol. V. p. 2613, Q51, quoted below). He also testified in the Hyde case that he had obtained a mineral-froth with cosmos oil, a heavy lubricating oil, presumably a petroleum (Vol. II,

p. 1062, Q110, Q119, Q123) and this also he repeats in the instant case (Vol. V, p. 2613, Q51, quoted below). As to both of these oils he made no examinations for determining their purity. His testimony in the instant case on these subjects is here quoted (p. 2613):

> "Q51. You mentioned two especial instances wherein you had obtained a mineral froth with petroleum oils. What were those exceptional instances?
>
> A. One of them was the use of the material known as petrol which is used for motor cars in England and the other was in the use of a heavy lubricating oil such as is used for valves, and known as cosmos oil.
>
> Q52. And is petrol in England the equivalent of gasolene in America?
>
> A. Yes, it is the trade equivalent. It it rather lighter.
>
> Q53. Did you examine these oils at the time that you made these experiments, for the purpose of determining the purity?
>
> A. No, I did not."

As to kerosene, known in England as paraffine, this oil was customarily used in the Cattermole metal-sinking process. So also was petroleum residuum, the Elmore oil. For metal-agglutination they were useful, but they have never been used to form a mineral froth. Mr. Higgins, in his report of March 16, 1905, wherein he describes the experiments, in which, by reducing the proportion of oleic acid in Cattermole operations, he first produced the air-mineral-froth, mentions tests with paraffine and a crude petroleum, and says (Vol. II, p. 662):

> "A diminution of the percentage of oil when that oil is either paraffine [kerosene] or Balkhany crude oil, *does not cause a similar frothing to the oleic acid,* but a diminution in the size of the granules and an increase in the time required for clean up of the sands."

That is to say, with these oils, no mineral-froth was formed when the amount of oil was reduced below Cattermole proportions—the Cattermole results were merely impaired.

Since March, 1905, Mr. Higgins has been continuously engaged in the study and development of the air-froth-flotation process, chiefly in the laboratory, but occasionally in the mill (Vol. V, p. 2471, Qs3-7). He testifies (p. 2613):

> "Q49. Have you ever obtained mineral froth by the use of kerosene alone?
> A. No, I have not."

And, identifying the paraffine of his report with kerosene:

> "Q50. By what name is kerosene known in England?
> A. Paraffine oil or simply paraffine."

He also testified (Vol. V, p. 2544):

> "Q407. What has been your experience with kerosene as a mineral-frothing agent?
> A. *Kerosene is not a mineral frothing agent.*"

Thereupon be performed a test in Court with defendant's ore and with kerosene at 2 pounds to the ton (0.1%) (p. 2544, Qs409-415), as a result of which "everything was sunken."

The experiment was in miniature. Instead of using the ordinary laboratory apparatus known as a slide machine Mr. Higgins used a bar mixer, which happens to be an efficient agitator and which had been used by one of defendant's witnesses Mr. Phillips in a whole series of experiments, the results of which are photographed in Defendant's Exhibits 52 to 123, inclusive (Vol. VI, pp. 2777-2847). Mr. Higgins used this apparatus in his series for purposes of comparison with Mr. Phillips' experiments. It is an efficient agitator, and when honestly used with uncontaminated materials its results are informative to the skilled metallurgist and illustrative to the court.

Mr. Higgins then added pine oil in the same proportion, 2 pounds to the ton (0.1%), to the pulp which contained the kerosene. Thereby the whole operation was altered and a

mineral laden froth was produced upon renewed agitation. Mr. Higgins testified (p. 2545):

> "Q419. Now, what have you produced as the result of adding one-tenth of one per cent. of pine oil and re-agitating for two minutes?
>
> A. A mineral-laden froth floating on the surface of the pulp and a fairly clean tailing sunk to the bottom.
>
> By the Court:
>
> Q420. Would it have been any different without the kerosene?
>
> A. Possibly it might be a little less. The coarser material has a tendency to fall out in the absence of sufficient oil to keep it there. We could get the same result with about four pounds of pine oil.
>
> By Mr. Scott:
>
> Q421. You mean that the kerosene helps to keep the mineral from falling out of the froth?
>
> A. Yes.
>
> By Mr. Williams:
>
> Q422. Does the kerosene assist in the froth formation?
>
> A. In small quantities it stabilizes the froth and prevents what we call showering, that is, the dropping out of the coarser particles from the froth."

This function of preventing the coarser particles from showering or dropping out of the froth is the only function that kerosene has ever performed in connection with mineral-froth-formation. It is performed when kerosene is used in minute proportions such as Mr. Higgins used in the above described experiments. This is true not only of kerosene, but also of fuel oil, the other petroleum used by defendant, and it is subject to a further limitation, that is, that this useful function has only been developed when there was present, in addition to a mineral froth-forming oil, which is an insoluble frothing agent, a substance capable of forming mineral froth which wholly dissolves in the water of the pulp, to wit, a soluble frothing agent. The process employing soluble frothing agents is the subject-matter of a later patent of petitioners No. 962,678 to Sulman, Greenway and Higgins. The witness, Mr.

Higgins is one of the joint inventors of that process. This patent, known as the solution patent, is in evidence herein as Defendant's Exhibit 218 (Vol. VI, p. 2920) and is explained in evidence (Higgins, Vol. V, pp. 2539-2543, Qs377-403; p. 2612, Qs39-42; Sadtler, Vol. IV, pp. 2120, 2121, Qs508-514).

Pine oil, which is the mineral froth-forming constituent of defendant's mixture, contains both insoluble frothing agent and soluble frothing agent, and its use therefore involves both the invention in issue and the invention of petitioners' later solution patent. Mr. Higgins explains this quite fully in the following testimony (Vol. V, p. 2612):

"Q38. What *frothing agents* were present in the operations of the defendant, those exhibited to you?

A. Pine oil, both the insoluble pine oil and the soluble pine oil.

Q39. About the other oils that were used, fuel oil and kerosene?

A. In small quantities fuel oil and kerosene are useful in the process in the patent in suit, chiefly for the purpose of preventing the coarse mineral from falling out of the froth. *Used over and above that quantity,* they are inert and may even be harmful to the process.

Q40. What is the effect of the use of a soluble frothing agent in conjunction with these large quantities of such oils as kerosene and fuel oil?

A. The addition of a soluble frothing agent causes the detrimental effects of the inert oils such as kerosene and Jones oil and fuel oil, to be more or less overcome.

Q41. When employing soluble frothing agents do you or do you not obtain as stable a froth as when you employ oily frothing agents in the manner of the patent in suit?

A. If the ore treated happens to be moderately coarse, then the oily agent gives a very much more stable froth than the soluble frothing agent; but if the mineral is ground sufficiently fine there is very little difference in the stability of the two froths.

Q42. And what is the effect of adding a small quantity of these oils which you have characterized as *inert* to *a soluble frothing agent?*

A. That prevents the falling out of the coarse particles from the froth. *Only* a very small quantity is necessary

for that purpose and above that quantity the oil remains inert until it gets in such large quantities that it becomes harmful to the process."

Following the illustrative experiments showing that kerosene oil does not produce a mineral froth, but that when a minute amount of pine oil is added to it, it does produce a mineral froth, Mr. Higgins made similar experiments with a mixture of kerosene and Jones oil (one of defendant's fuel oil equivalents) and here he used the proportions of these oils that defendant uses in its operations. He testified as follows (p. 2545):

"Q423. State whether or not *a mixture of kerosene and Jones oil* is an efficient froth producer.

A. It is not, and I would like to show a similar experiment, showing that the Jones mixture with kerosene does not make a froth, while the addition of pine oil brings up the froth."

He then performed the experiment with the petroleum constituents of defendant's mixture in proportions used by the defendant for an aggregate amount of oil mixture of 22 pounds to the ton of ore (p. 2545, Qs424-426; p. 2548, Qs444-447; p. 2549, Qs458, 459) and he describes the result of its operation as follows:

"Q460. Now what is the result of the 4-minute agitation?

A. There are a few bubbles on the surface of the pulp carrying mineral, but there is no thickness of froth there. The general result seems to be a film of mineral floating on the surface, carrying a few bubbles.

Q461. As a metallurgical result has that any value?

A. None whatever."

Then he added pine oil in the proper proportion for defendant's mixture at 22 pounds, to wit, about 4 pounds to the ton, 0.2%, and re-agitated (p. 2550, Q462) and testified as follows describing the result (p. 2550):

"Q463. What is the result of the addition of four pounds of pine oil and the reagitation?

A. That has brought up to the surface of the pulp, a heavily mineralized froth, which appears to be rather denser than in the case of the kerosene and pine oil alone, the the previous experiment."

That is to say, comparing the kerosene and pine oil experiment with the kerosene, fuel oil and pine oil experiment, both produced heavily mineralized froth, and the latter was a rather denser mineralized froth.

This last experiment reproduced in miniature what defendant does in its mill, and the sequence of experiments exactly analyzes defendant's proceedings. Kerosene and fuel oil with defendant's ore cannot form a mineral froth. When the mineral froth-forming oil is added in critical proportions, a mineral froth is formed.

These experiments stand upon the record absolutely uncontradicted. Expert metallurgists present in behalf of defendant had no criticisms. The experiments were performed in small vessels having no conveniences for the removal of the froth, and no assays were demanded or made. The expert metallurgists of defendant accepted the testimony of Mr. Higgins without contradiction or criticism or any effort to repeat the experiments above described.

Of greater evidential weight than the experiments, however, are the full scale operations in commercial plants the world over. It is a large fact of the case that although kerosene is a cheap oil as compared with mineral froth-forming oils, and fuel oil is a great deal cheaper than kerosene, and these oils are everywhere available, no operations have ever been carried on wherein kerosene and fuel oil functioned as mineral froth-forming oils. Their limited utility described by Mr. Higgins in the testimony above quoted, in preventing coarser minerals from falling out of a froth, thereby economizing in the cost of grinding, has been at times available and availed of, but this function, as the evidence shows, is utilized when these oils are

employed in minute amounts, and when they are used with mineral froth-forming oils and soluble frothing agents. When thus used they may not be said to be inert. Above these minute proportions, as Mr. Higgins says of these petroleum oils "the oil remains inert until it gets in such large quantities that it becomes harmful to the process" (Vol. V, p. 2612, Q42).

Mr. Higgins' testimony in this regard is confirmed by Mr. Chapman, who has installed the process in suit in Australia, Russia, Sweden, Wales, and numerous places in the United States, and studied and improved its operations in South America and Cuba, as the evidence shows. After inspection of defendant's operations on January 29, 1917, he testifies (Vol. V, p. 2459):

> "Q38. What factors in your opinion contributed to making that process the agitation froth process, in view of the amount of oil that was being fed into the plant?
>
> A. By adding suitable oily reagents to the pulp of finely crushed ore and water and agitating to produce a separation and froth, is what I understand to be the agitation froth process. *The admission of these oils may be sometimes of two characters, those that are actually active in the process, and perform the necessary functions, and those that are inactive in the process.* I have on many occasions used inactive oils, particularly those like fuel oil, kerosene and stove oil to produce a condition of froth in the spitz box that will maintain a steady condition of overflow. The addition of these reagents in small quantities is extremely useful for this purpose and considerably eases up the operating work.
>
> Q39. Then, as I understand you, such oils as fuel oil and kerosene and stove oil are not active oils in the agitation froth process?
>
> A. Not to my knowledge.
>
> Q40. And your knowledge is based upon what? A. My practical experience since 1905 in the agitation froth process."

Mr. Greninger has also made numerous installations of the process in suit in the United States and Canada and he testifies to the same effect, as follows (Vol. VI, pp. 2420, 2421):

"RQ189. Now, what has been your experience in the use of fuel oils and petroleum oils generally in the froth flotation process of Minerals Separation Limited?

A. I have *never been able to make* any use of them—I will say *any beneficial use*—as regards the extraction of minerals—*of any mineral oils* which I have tried. I have used them for other purposes, but I did not consider them at the time as being useful in the extraction of mineral.

RQ190. For what purpose have you used them?

A. I have used stove oil for the purpose of thinning thick tar product so it would be easily fed through a small opening.

RQ191. In what proportions have you used that, small or large?

A. This amounted to about 75% of the total oil used, being the amount necessary to thin the tar to such an extent that it would pass through a small opening at the rate I required.

RQ192. And now, as the result of your experience, how would you characterize those oils in the froth flotation process, as active or inactive?

A. In my experience, in all cases where I have tried them, they have been to my knowledge *inactive* and I would so characterize them.

RQ193. Where you have used them, have you used them alone, or in mixtures?

A. I never have used them or attempted to use them alone—I will qualify that; I attempted to use *stove oil and fuel oil* alone—that is, a combination of the two, but *failed to get any metallurgical results.*

RQ194. Whenever you used these inactive oils, was there or was there not a *soluble frothing agent present?*

A. There was."

He further testified (p. 2422):

"RXQ204. When you used what you call the inert fuel oil, using 75 per cent. of the fuel oil and 25 per cent. of the tar—is that right?

A. Yes.

RXQ205. How much oil did you use per ton of ore?

A. In the vicinity of two pounds per ton.

RXQ206. Of that mixture?

A. Of the mixture, I would say approximately two pounds to the ton."

This evidence is uncontradicted.

Defendant's witness Thomas A. Janney, it is true, described a full scale experiment wherein he ran one of the flotation plants at the Arthur mill of the Utah Copper Company for a period of twenty-four hours, during which only fuel oil and Jones oil were added to the pulp, but the pulp was abundantly charged with dissolved mineral-frothing agents, so that he was in fact carrying on the process of the solution patent. This experiment is tabulated in Defendant's Exhibit No. 31 (Vol. VI, original paging 4995, following p. 2736) and is No. 20 of the experiments there tabulated. These twenty experiments were performed under such conditions that no one could tell what amounts of soluble frothing agents were present, the one certain fact being that they were always present in substantial amounts.

As to experiment No. 1, run on March 30, 1917 (Vol. III, p. 1516, Q64) the amount of oil mixture fed in the pulp was 1.6 pounds per ton of ore. But the pulp was fed from vast reservoirs to which had been returned the middlings of the run of the preceding day (experiment 2, March 29; p. 1534, XQ225) during which 3.75 pounds per ton of oil mixture had been fed into the pulp; and the middlings came back with 41.4 pounds of an oil mixture, not analyzed, but only determined in bulk, per ton of circulating middlings, as determinable by simple calculation from the total circulating middlings and the total oil therein. Mr. Janney admits that the contents of the two reservoirs or Dorr tanks which received both new feed and circulating middlings and which fed all the pulp of the flotation plant, is "something enormous" and that as they "operate from day to day these tanks or these two tanks become contaminated or contain so much oil that is carried over from the day before" (p. 1550, XQ401).

The testimony immediately following this admission is here quoted (pp. 1550, 1551):

> "XQ403. So that as far as this sheet is concerned, showing what came in there, or 1.60 of oil, it is utterly useless?
>
> A. With 1.60 pounds of oil, yes.
>
> XQ404. It is utterly useless?
>
> A. Yes.
>
> XQ405. And it is utterly useless as to every one of the figures as to any of the quantities or amounts under 1.60?
>
> A. Yes, sir.
>
> XQ406. Because in each instance the amount of oil you actually were operating with was entirely different from the figure appearing in the column in which the first figure is, 1.60?
>
> A. Yes, sir.
>
> XQ407. And when you made an experiment there was no way of demonstrating the verity of it unless you knew what was in the Dorr tank before you began? Isn't that correct?
>
> A. I could not tell how much oil I was going to use until afterwards.
>
> XQ408. Yes, and you could not tell about a great many other factors because of the remnants of the previous day's operations that had not been cleaned out? Isn't that true?
>
> A. Yes."

In the Brief for Respondent in opposition to petition for certiorari the experiments of this series are referred to in a footnote on page 21, and it is said (pp. 21, 22):

> "The determinations given in detail in the footnote are *not contradicted or questioned,* and they prove that the petroleum oil used in this process was by no means inactive or inert."

It is submitted that Mr. Janney's admissions in cross-examination completely destroy the value of his experiments and not only question but contradict all the tabulated results and all of defendant's conclusions therefrom. In fact these experi-

ments merely show, as do the operations in defendant's mill, that in the presence of a sufficient amount of soluble frothing agent, the inactive petroleum oils used by defendant may be employed in quantites such that the total oil proportions approximate one per cent. on the ore, and yet air-froth flotation ore concentration may be effectuated, although with impairment of the operations.

It should be noted that, in the solution process, the frothing agent, being dissolved in the water, does not coat the mineral. It may therefore be used in any quantities from the minimum necessary to perform the desired operation to the maximum of saturation of the water above which the water of the pulp will not dissolve it (Higgins, Vol. V, p. 2543, Q399). A larger amount than is necessary of dissolved soluble frothing agent does not interfere with the operation of the air bubbles. At the end of the process it is found in the solution, not on the particles (Qs400-402). On the other hand the oily frothing agent of the process in suit is found at the end of the operation on the metalliferous mineral. Mr. Higgins says (p. 2543, Q403), comparing the process in suit with the solution process:

> "Q403. And in that respect how does it compare with the soluble frothing agent? Where do you find that at the end of the operation?
>
> A. That oil is found at the end of the operation on the concentrate chiefly. A very small portion may be found in the tailings, but the water is particularly free from it and it is no longer useful as a frothing agent. That makes a big contrast in [with] the solution patent where the frothing agent remains in the solution and the solution can be used over again usefully."

Mr. Janney's deceptive experimental runs may well be contrasted with the frank admission of Mr. Englemann, flotation foreman of defendant's ally the Ray Consolidated Copper Company, who admitted that efforts had been made to operate at his plants on straight fuel oil at various times (Vol. IV, p. 1871, Q78):

> "but we could never maintain metallurgical results."

There is in the *moving pictures* in evidence, an interesting scientific demonstration of the fact that kerosene and fuel oil are not mineral-froth-forming oils, and that either or both, when mixed with pine oil, do not prevent its bubble-modifying effect. Bubbles formed in pure water are shown (Scene 20, Vol. V, pp. 2527, 2528). The moment agitation stops the bubbles disappear. Then magnified views are shown (Scene 21, p. 2528). The bubbles are seen to coalesce in the water with explosive violence and to grow rapidly larger and to be incapable of maintaining their spherical form when in motion, but to elongate into egg form. This is contrasted with water modified by oleic acid (Scenes 22, 23, p. 2530) wherein a persistent cloudy mass of bubbles appears, so minute that they cannot be individually seen when greatly magnified. This is repeated with pine oil (Scenes 24, 25, p. 2531), showing the same effect but with bubbles still finer, rising in clouds like the smoke of a forest fire. Then with kerosene oil (Scenes 26, 27, 28, pp. 2531, 2532), the above described results of pure water are repeated except for the fine subdivision or emulsion of the kerosene oil itself in the water, without air bubbles. The enlarged view (Scene 28) is practically a repetition of what is shown with pure water, and shows that kerosene oil is not a frothing agent. Then pine oil is added to kerosene oil (Scenes 29, 30, p. 2532) and the pine oil conditions are substantially reproduced. Then defendant's mixture, pine oil, fuel oil and kerosene oil is produced by adding fuel oil, and again the pine oil bubble-modifying effect is substantially unchanged (Scene 31, p. 2533).

The use of *minute amounts of inactive petroleums* in conjunction with mineral-froth-forming oils and soluble frothing agents is quite frequently referred to in the testimony. This use was first developed at the Braden mine in Chile, South America, where the aggregate oil proportions were 4 pounds to the long ton of ore, 0.18% on the ore (*supra*, pp. 64, 65); and later at the Britannia Mining & Smelting Company plant in Canada, where the aggregate oil used was 2 pounds to the

ton, 0.1% on the ore (*supra*, pp. 65, 66). Other examples are given in the descriptions of various commercial uses of the invention, including the use of the invention by the infringers allied with the defendant. These latter always used the inactive petroleum oils in minute amounts until after the decision of this Court in the Hyde case. Then they increased the amount of inactive oils and continued to use critical proportions of active oils. Most of these infringers appear to have obtained the usual benefit from the use of these petroleum oils in minute amounts, that it helped to prevent the coarser mineral particles from falling out of the froths and economized in grinding. In the defendant's mill, however, there was evidently no benefit to be gained by the use of these cheaper petroleum oils, as defendant did not use these petroleum oils in its mill operations until after the decision of this Court in the Hyde case, and then these mineral oils were added to the mineral-froth-forming oil, pine oil, which alone had been employed in highly successful operations for some two years. Seeking some means of disguising its operations, defendant added these inactive oils, but was still compelled to use the mineral-froth-forming oil with critical proportions slightly increased. The operations thus conducted were *mere camouflage*. The process in suit was used, less efficiently, at substantial financial loss.

In the Brief for Respondent in opposition to certiorari, at pages 23 and 24, there is a description by counsel of illustrative experiments before the Circuit Court of Appeals in the instant case which defendant's counsel assert convinced that Court that these petroleum oils will produce a mineral froth. It is enough to say of this description that it is inaccurate, in fact, untrue. Obviously, the description by counsel is not evidence, and the effort thereby to contradict facts indubitably established by the evidence, is futile.

The Kerosene Oil Used in Defendant's Court Experiments Was Contaminated With Soluble Frothing Agent.

At the trial of the instant case Mr. Phillips, a witness for defendant, produced a large number of photographs, said to be of froths made by him in small square glass jars, with an agitator known as a bar mixer. These photographs are Defendant's Exhibits 52 to 153 inclusive (Vol. VI, pp. 2777-2847). Three of these photographs, 18-3, 18-2 and 18-1 (Defendant's Exhibits 100, 101, 102, Vol. VI, pp. 2825-2827), are of an experiment said to have been made with 25% of kerosene oil (Vol. IV, p. 1704, Q229). This experiment was repeated at the trial (pp. 1705, 1706, Qs238-244). At the request of petitioners' counsel this machine was delivered to petitioners' experts with specimens of the materials used. Mr. Higgins repeated the experiment with the materials supplied by defendant, and got the same results as Mr. Phillips did (Vol. V, p. 2551, Qs481, 482). Then he repeated it with kerosene of his own laboratory, and could not get the same results, and he had a sample of kerosene sent from the Union Oil Company, who supplied defendant, and bought six different kinds of kerosene in Butte from different stores and made a great number of experiments (p. 2552, Q484). With these eight varieties of kerosene all he could get was a thin layer of floating material which was a layer of oil carrying a little mineral, with the bulk of the oil and mineral at the bottom of the vessel, looking like soft granules (Qs485, 486). Thereupon he examined the kerosene used by Mr. Phillips and found that it "contained a small amount of soluble frothing agent that was sufficient to produce the result obtained" (Q484). He tested the other eight varieties of kerosene and found that "none of those contained any soluble frothing agent" (*ib.*).

This soluble frothing agent "smelled of varnish, which was probably due to some pine oil" (*ib.*). Petitioners' chemical expert Dr. McIlhiney also examined the specimen of the kero-

sene used by Mr. Phillips, and also another specimen of kerosene used by Mr. Dosenbach in his 25% alleged kerosene experiment alleged to represent the Kirby patent. Dr. McIlhiney testifies as follows (Vol. V, p. 2594):

"Q62. Did you examine the specimen of kerosene oil supplied by the defendant as corresponding to that used by Mr. Phillips in his 25% kerosene oil experiment made in court?

A. I did.

Q63. What was your examination and what did you find?

A. I found that it contained a soluble frothing agent, and I separated that frothing agent from the main body of the oil by dissolving it in water, and examined the water separately, and found that it gave every evidence of containing a soluble frothing agent.

Q64. Did you make any concentration?

A. Yes; I not only examined the water solution itself, but I concentrated the ingredients into a smaller volume by distillation or by rectification, and found that the liquid when concentrated gave more marked indications than the original water solution from which that rectified material was obtained.

Q65. Was there any odor about it?

A. Yes, there was. The water, after having been separated from the kerosene, carefully, had an odor which was entirely different from that of kerosene, which was rather indeterminate in character, but I should be most inclined to refer it to some kind of pine oil or some trace of wood product.

Q66. Did you examine the specimen of kerosene or petroleum distillate supplied by the defendant as corresponding to that used by Mr. Dosenbach in his experiment with 25% of kerosene, said to represent the Kirby patent?

A. I did, and I found the material to show qualitatively the same character as the kerosene sample that I have just described.

Q67. That is to say, what did it contain?

A. A soluble frothing agent."

Mr. Higgins verified these determinations by adding pine oil to uncontaminated kerosene, thereby exactly reproducing

what Mr. Phillips had produced in his court room experiment. This Mr. Higgins did in a bar mixer with a small square glass jar, thus exactly repeating the Phillips experiment without variation of apparatus. First he added uncontaminated kerosene at 25% to defendant's ore (p. 2552, Q487) and reproduced in court what he had obtained with uncontaminated kerosene, a thin float about three-sixteenths of an inch thick, with free oil showing on the surface, and the bulk of the oil and mineral and gangue at the bottom of the vessel (Qs488, 489). This operation, he testified, was metallurgically useless (Q490). Thereupon he added pine oil at the rate of 2 pounds to the ton of ore and re-agitated (*ib.*). The result was that practically the whole of the mineral and oil rose to the surface (Q491) and he obtained a float about the same as Mr. Phillips had obtained, although perhaps a little thicker or deeper (Q492). This float he describes as a magma or paste (Qs493, 494) containing air (Q495). It is fairly represented in defendant's photographs, and its resemblance to a mineral-air-froth is so close that the untrained eye cannot distinguish it from a mineral-air-froth.

This evidence stands uncontradicted. Indeed it is largely confirmed by defendant's evidence. Mr. Dosenbach had suggested the possibility of contamination of defendant's oil in testifying that at defendant's plant they frequently used their oil storing tanks successively for different oils, and that Mr. Phillips' specimen, as well as those that he (Mr. Dosenbach) used in court came from the stock supply at defendant's plant (Vol. IV, p. 2187, XQs149-156). Of course it was only necessary to put the kerosene in a tank that had contained pine oil, and nature did the rest. Following this exposure defendant recalled its expert Dr. Sadtler in respect of this point (Vol. V, pp. 2635-2638, Qs1-3) and although he attempted to minimize the effect thereof, he admitted that the kerosene oil in question was contaminated and that the separated portion gave out a "slight woody odor" (p. 2637), thereby confirming the testimony of petitioners' witnesses, Mr. Higgins and Dr. McIlhiney.

Prior Documents.

In the Hyde suit it was contended that the patent in suit was anticipated by the disclosures of certain prior documents. A considerable array of such documents is in evidence. Every one of them referred to at the trial herein, except the California Journal of Technology, was in evidence in the Hyde case and was disposed of by the decree of this Court in that case.

Defendant's briefs in the Circuit Court of Appeals did not mention the California Journal of Technology, the only new alleged anticipation. Apparently, therefore, it is abandoned. But while abandoning any defense of anticipation, defendant throughout brief and argument presented the false assumption that there existed in the prior art processes exactly the same as the process in suit except that they employed more oil, and the Circuit Court of Appeals adopted this argument. This is absolutely false, and its falsity can best be shown by a consideration of such of the actual disclosures of those documents of the prior art as are referred to in the new evidence in the instant case.

Haynes British Patent.

This patent No. 488 of 1860 (printed Vol. II, pp. 765-768) was offered in evidence in the Hyde suit and contains the first suggestion of the use of oil in ore concentration.

The evidence in the Hyde case in behalf of plaintiffs describing this patent was uncontradicted, and may be summarized as follows (Liebmann, Vol. I, p. 466):

> "The Haynes British patent No. 488 of 1860 contains the first disclosure of the use of oil for ore concentration. The ore is mixed with oil to form a stiff paste, which is then kneaded with water to wash out the gangue. It is not a practical process."

The Haynes process is measured at its true value in the Privy Council judgment (*Ore Concentration Company, Ltd.* vs. *Sulphide Corporation, Ltd.*, 31 R. P. C., 206), as follows:

> "Haynes patent, published in 1860, describes a method of separation of metal from gangue by the use of an agent containing fatty or oleaginous matter. This document is, however, not more than an indication of the date at which attention was first directed to the affinity of oil for metals."

The reference to the Haynes patent by this Court was to the same effect (242 U. S., 263).

At the trial of the instant case defendant's patent expert Dr. Sadtler classifies the Haynes invention as one in which all of the ore particles were agglomerated by oil into masses, from which the gangue was separated by a washing out process (Vol. III, p. 1630, Q6), and says that he does not cite it "as prior art, strictly speaking" (p. 1661, Q129). This is accurate and disposes of the error of fact that it discloses a process producing mineral froth.

Everson Patent.

This patent No. 348,157 dated August 24, 1886 (printed Vol. III, pp. 1209-1211), was one of the five patents finally relied upon in this Court by the respondent (defendant) in the Hyde suit as an anticipation of the patent in suit (242 U. S., 263). It was also referred to as one of the two patents which the defendant Hyde selected as giving the whole basis of flotation concentration (*ib.*). This Court cites it as disclosing a process for utilizing the affinity of oil for metals (p. 264) and cites it again as disclosing increase in the selective property of oils by the use of acid (*ib.*). No further identified specific mention is made of this patent by this Court, but it is undoubtedly included in the general classification as a process which

> "consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass—'the pulp'—thus formed so as to separate *the oil, when it became impregnated or loaded with the metal and metal-bearing particles,* from the valueless gangue" (242 U. S., 264).

This Court then classifies all of these patents, including the Everson, into either a "surface flotation process" or a "metal-sinking process." The first class is stated to depend upon oil-buoyancy for carrying the metal to the surface. There is no specific statement as to which of the five alleged anticipations are included in this class, although obviously it includes four of them, Froment, Glogner, Schwarz and Kirby. The other alleged anticipation considered by this Court and principally relied upon by the defendant was the Everson patent. It does not depend upon oil-buoyancy for carrying the metal *to the surface*. Its *first method*, wherein a little over 5% of oil is used (Liebmann, Vol. I, p. 461) is clearly and admittedly a procedure wherein all of the particles of the metal are agglomerated by oil (in this case a compound including oil) into a pasty mass or masses from which the gangue is separated by washing it out, like Haynes and Cattermole (Sadtler, Vol. III, p. 1630, Q6; pp. 1661, 1662, Q129; Vol. IV, p. 2049, original paging 3611). Its *second method* wherein 17 or 18% of oil is used (Liebmann, Vol, I, p. 462; Sadtler, Vol. III, pp. 1662, 1663) does not employ sufficient oil to float the metal *to the surface* by oil buoyancy. In this second method the oil *lightens the metalliferous mineral* and *"the sand and mineral are merely transposed or their relative positions are reversed"* (Vol. III, p. 1209, Everson Spec., p. 2, lines 108, 109) from the ordinary conditions which then prevailed in the "wet separation of ores" (Everson Spec., p. 2, lines 113, 114), so that the mixture of oil and mineral was removable, as Everson says, by "devices and methods now well known in wet separation of ores" (Everson Spec., p. 2, lines 105, 106). This Everson said could be accomplished "by means of a constant overflow of water from a washing out vessel" (Everson Spec., p. 2, lines 102-104).

In testing the process plaintiff's experts at the time of the Hyde suit tried a washing out vessel such as was used in Everson's day for classifying the ore (and not for concentrating the ore) with an up current of water to

carry away the mixed oil and metal in suspension, but the results were wholly unsatisfactory (Liebmann, Vol. I, pp. 366, 367; Chandler, pp. 524, 525; Higgins, pp. 550, 551, Q28). As Dr. Chandler says "the separation was a complete failure" (p. 525) and the assay of his test showed tailings richer than the original ore and concentrates leaner than the original ore (p. 551). This was disappointing. Finally, however, after the closing of testimony in the Hyde suit, it was found that if the operation of separation were performed in a miners' washing pan or batea a fair concentration and substantial recovery were attainable (Higgins, Vol. V, pp. 2474, 2475, Qs24-37). This experiment was performed at the trial of the instant case (pp. 2478, 2479, Qs57-60) and resulted in concentrating material containing 4.64% of copper to 12.8% of copper with a recovery of 53.8% of the metal (Vol. VI, original paging 5562, preceding p. 3087). This was contrasted with an ordinary operation of wet separation carried on in the batea wherein the sand was carried off in suspension in the overflow over the edge of the vessel, and the metal remained in the vessel (Vol. V, p. 2475, Qs38-40, and following cross and direct examination to Q58). Both experiments were representative of what would occur in a large operation on a shaking table such as was used in the wet concentration of ores at the time of the Everson invention (p. 2475, Q29), and the two experiments well illustrate Everson's statement that the reverses ordinary water concentration, and the experiment with oil demonstrates the possibility of a reasonable concentration even though with heavy losses in accordance with the disclosure of the Everson patent. In both experiments the escaping material overflows in suspension in the overflowing water. According to Everson the overflowing material is a mixture of oil and metal. With water concentration the overflowing material is sand. The fact that Everson's specified proportions exactly fit the standard batea (Q31) tends to confirm the view that petitioners' experts have reproduced the identical experiment

which Mrs. Everson performed in her laboratory at the time of the making of the invention.

These batea experiments were repeated before this Court, at the argument of the Hyde case, with the consent of the Justices, after a statement had been made that they were not in evidence in the Hyde suit, but were repetitions of experiments made in the Miami suit.

In view of the fact that wherever one material is separated from another by an overflow or upcurrent (Higgins, p. 2480, Q77) it sinks relatively to the overflow or upcurrent which carries it away, it would seem reasonable to conclude that this Court included the Everson second method as well as the Everson first method in its general class of metal sinking processes. Certainly the recovery of sand by overflow in ordinary ore concentration would not be a sand flotation process (Qs69-77), and therefore the recovery of mixed oil and metal under exactly similar conditions and with similar carrying off of the substance separated in suspension in water would not be a metal flotation process, and the term used by this Court "surface flotation process" excludes these procedures.

Mr. Higgins gave several references to the literature of the days preceding the Everson invention wherein the word "floated" is used to describe the flowing in suspension of particles heavier than water (p. 2480 et seq., Qs78-83; Qs92-95). This fully explains the use of the words "floated off" in her statement "by which overflow the concentrate will be floated off" (Everson Spec., p. 2, lines 104, 105), this statement being followed by that as to devices and methods then well known in wet separation of ores, and that "the sand and mineral are merely transposed or their relative positions are reversed" (Everson Spec., p. 2, lines 107-110).

This Court having decided that the Everson patent does not anticipate the patent in suit, it would seem to be unnecessary to give further consideration to that patent. Indeed the defendant did not at the trial of the present case attempt to demonstrate that in any apparatus known at the time of the Everson patent and then used in the wet concentration of ores

it could carry out what its experts and the expert of the defendant in the Hyde suit put forward as their view of the Everson process. Defendant's testimony was confined to a reference to churns, oil-purifying apparatus, spitzkastens for classification with slime overflow, and dollies or mixing tubs, as apparatus that might possibly be used to carry on the Everson second method. One of these devices, called the "Cataract Machine," an oil purifying device, was altered so as to make it possible to carry on in it a very violent agitation which abundantly aerated an ore pulp and with the use of an oil which apparently was a kerosene contaminated with a soluble frothing agent. It is to be remembered that the oil of Everson's second method was a petroleum oil only slightly heavier than kerosene, which cannot produce a froth, and that even for the production of an air-inflated paste or magma by terrific agitation, the presence of a soluble frothing agent is necessary.

Cataract Oil-Purifying Machine.—This oil-purifying machine is described in a book by Andes published in 1882. In operation, by stirring, a circulation is established, outward in the lower part of the vessel, upward near the walls of the vessel and back into the middle. The description says (Vol. IV, p. 1668):

> "The oil therefore makes a circuit and during this circuit there is so intensive a mixing and so powerful an agitation, and thereby so intimate a bringing in contact with the atmospheric air as can be obtained by no other machine and can be accomplished in no other way."

This is a description of such a stirring as constantly exposes new surfaces of the oil to the air. Probably the device was quite effective, operating in this manner, in the purification of oil. It is also said to be useful in mixing dry color with lacquer for making varnishes. Obviously it was never operated at such a speed as to beat the oil or varnish into a foam or froth. This would have been highly objectionable and the machine was not so constructed as to permit it to occur.

Obviously Mrs. Everson did not intend to include any such device in her statement as to the manner in which her process was to be carried out in practice, as follows:

> "A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores" (Everson Spec., p. 2, lines 112-114).

If, therefore, it were possible in this oil-purifying device to replace the oil by an ore pulp, and by carrying on the operation which had characterized the device in the purification of oils to carry on in it the Everson process, that fact would be wholly irrelevant because it would be no part of the disclosure of the Everson patent.

In fact, however, defendant did not reproduce this Andes cataract machine and did not carry out in this cataract machine, with an ore pulp, the operation which charaterized that machine. Defendant altered the oil-purifying device materially for the purpose of adapting it to what defendant wished it to do, and then carried on in it an operation wholly different from any operation such as characterized the apparatus disclosed. An examination of the drawing (Plaintiff's Exhibit 254; Vol. VI, p. 2992), showing in contrast the cataract machine as disclosed by Andes and the so-called cataract machine as constructed by the defendant's experts, very clearly shows that the Andes machine as disclosed would not do what defendant wanted it to do and therefore defendant made a wholly different machine to accomplish its purpose of misrepresentation.

Fryer Hill Publication.

This document (printed, Vol. II, pp. 600, 601) was in evidence in the Hyde suit. It fails to give a definite disclosure of any process. The name Everson does not appear in the publication. The description indicates that whatever it attempted to describe was a bulk oil or an oil-buoyancy flotation process.

If it describes anything which grew out of Mrs. Everson's invention, then it shows that Mrs. Everson advanced to the point of oil-buoyancy flotation, thereby anticipating Elmore. In fact, however, the disclosure cannot anticipate anything as it does not make a full disclosure of any process.

There is not a word of evidence connecting this publication with Mrs. Everson. In commenting upon this disclosure Dr. Liebmann said that there were several facts appearing in the description which induced him to believe that this extract referred to an experiment according to the Everson patent (Vol. I, pp. 369, 370, Q8), and Dr. Chandler said that it "describes an effort to use a process resembling the Everson process on silver ores" (Vol. I, p. 525). Both are in agreement that no clear disclosure is contained in this document of any process. At the trial of the instant case defendant produced a wonderful product of ingenuity which was alleged to be such a machine as is described in this publication, and operated it at a speed between 1400 and 1500 revolutions a minute (Dosenbach, Vol. IV, p. 1889, Q31), and by this terrific agitation and the employment of an oil which was probably a kerosene contaminated by a soluble frothing agent, succeeded in producing a float containing a fair amount of metalliferous mineral.

Everything about this experiment was ridiculous. The character of the agitation is indicated in the publication by the description of the agitator as arastra-like, as well as by the description that the agitation keeps "the whole mixture in motion." The character of the result is indicated by the fact that it causes "the mineral-charged oil to float," and the statement that the oil is "laden with its precious freight" and the repeated further description of the product as "mineral-laden oil." The disclosure calls for the use of steam introduced at the bottom of the mixture and the injected steam in connection with the revolving device are said to jointly contribute to cause the "mineral-charged oil" to float. The defendant's operation of its spurious machine was a violent agitation for the purpose of aeration with no attempt whatsoever to utilize steam. This

operation is well characterized by the testimony which Dr. Sadtler admits that he gave in cross-examination in the Miami case (Vol. IV, pp. 2087, 2088) describing a similar operation of a similar machine (Dosenbach, Vol. 6, pp. 1942, 1943, XQs371-376) in which Dr. Sadtler said that there was nothing in this publication which defined the nature of the agitation, that the specific description therein was "a very vague statement," that the publication contained no directions as to the quantity or proportion of oil to be used or as to the speed of agitation or directions representing any definite mechanical structure, and finally that the "very vague outline of this newspaper article is entirely compatible or in accord with what could be done." The law is well settled that a disclosure relied upon to anticipate an invention

> "must be an account of a complete and operative invention capable of being put into practical operation."

The above language is quoted from *Seymour vs. Osborne*, 11 Wall., 516, 555. Obviously the Fryer-Hill publication does not disclose a mineral-froth-producing process.

Crilley-Everson Publication.

This document (printed, Vol. II, p. 601) was in evidence in the Hyde suit. It was well described by Dr. Sadtler in the Miami trial, as admitted by him at the instant trial, as follows (Vol. IV, p. 2088, XQ231, quoting XQ689):

> "It does not, as a disclosure, give enough details to make it possible to carry it out in a definite and accurate way. It leaves entirely too much to chance."

In the instant case the extent of defendant's reliance upon this publication, as stated by Dr. Sadtler was that it contributed

> "only a picture of results of the account given in the Fryer-Hill publication" (Vol. IV, p. 2133, RQ571).

The absence of any statement in this publication as to the amount of oil used makes it impossible to affirm or deny that there was sufficient oil for oil-buoyancy flotation. The character of the oil used, however, described as "black thick oil," indicates oil-buoyancy flotation. The statement as to the result, the flotation of "a thick scum of sulphurets" (sulphides) also indicates oil-buoyancy flotation, since the floating mass of oil and ore of the Elmore process well responds to that description. Nevertheless, in the Privy Council case (*Ore Concentration Company, Ltd. vs. Sulphide Corporation,* 31 R. P. C., 206) it was rejected as not sufficiently definite to anticipate the Elmore process.

The only specific reference to this publication in the opinions in the Hyde suit was in that of the Ninth Circuit Court of Appeals, wherein it is joined to the Everson patent (214 Fed., 106).

A mere reading of the publication must lead to its rejection as not being "an account of a complete and operative invention capable of being put into practical operation" (*Seymour vs. Osborne,* 11 *Wall.,* 516, 555).

Froment Patents.

These patents in the order of their dates are first, the Italian patent No. 63,723, dated May 20, 1902, the latter being conceded to be the date at which it may be treated as effective (printed Vol. II, pp. 715-717; translation, pp. 717-718), and then the British patent No. 12,778, dated June 4, 1902 (that being merely the date of the filing of the provisional specification) and effective as a patent as of its sealing date, which is stipulated to be August 18, 1903 (Vol. I, p. 486). This patent was granted to Lake, a British patent agent, as a communication from Froment (printed Vol. III, pp. 1332-1334).

Briefly the Froment patents describe a test tube experiment with 10 grams (two-fifths of an ounce) of ore, at least 11.7% of oil (234 pounds to the ton of ore), which in a brief agitation carried on for one second of time produces a floating magma of

oil which carries metal particles in its mass and is inflated by gas bubbles. This floating magma diminishes in bulk and drops most of its metal when agitated for another second and is completely broken up and drops all its metal with a few seconds of agitation. This "metallic magma," as Froment accurately designates it, looks like a froth, but is wholly different in structure from a froth such as characterizes the process in suit. It is not an assemblage of air bubbles carrying metallic particles in their films, but a pasty mass of oil and metallic particles, lightened by entangled gas bubbles, and thereby made light enough to float and unreliably carry a fair amount of metal, but with the metallic particles distributed through the oil and not attached to the air bubbles at all. For air in oil has no attraction for metallic particles (Vol. V, p. 2525; pp. 2356, 2357, Qs44-47). The production of Froment's magma is an *interesting laboratory experiment,* but the procedure never got beyond the laboratory, and a paste or magma of oil and metallic particles lightened by air bubbles such as Froment produced has never been of the slightest value in the concentration of ores.

This Court refers to the Froment British and Italian patents as among the patents finally relied upon by defendant as anticipations (242 U. S., 263), and again refers to the Froment British patent as one of the two patents selected by the defendant Hyde, as giving the whole basis of flotation concentration (p. 264). The only further specific reference to Froment is as follows (p. 266):

> "Froment Great Britain patent (1903) * * * [is] especially suggestive of the advance which was being made toward the desired result, but the Froment process was little more than a laboratory experiment, and has never proved of value in practice."

This dismissed the Froment patents and the Froment description, next to be considered, as "little more than a laboratory experiment" and as merely suggestive of advance

towards the invention in suit, tending to diminish, it may be, the *length of the step* which the patentees took from Elmore, a workable flotation process, to the process in suit, which *"converted experiment into solution, 'turned failure into success'"* (p. 271), and wholly failing to anticipate the invention in issue.

The analogy is close between the case at bar and the *Telephone cases* (126 U. S., 1). There Reis had invented, widely published, and used a device for reproducing sound, which conveyed musical tones. Its fault was that the vibrations of the diaphragm opened and closed the electric circuit. By a trifling adjustment, the tightening of a screw, or the stiffening of a spring, it was possible to prevent the opening and closing of the circuit and to obtain the unbroken electrical undulations which characterized Bell's invention. This last step Reis failed to take. After the Bell invention had been made and published the Reis instrument was adjusted so that it transmitted speech. The prior art disclosed every detail of the Bell invention except the one point of adjustment so that the current would not be broken (126 U. S., pp. 539-545). As Mr. Chief Justice Waite said:

> "Under such circumstances it is impossible to hold that what Reis did was an anticipation of the discovery of Bell. To follow Reis is to fail, but to follow Bell is to succeed. The difference between the two is just the difference between failure and success. If Reis had kept on he might have found out the way to succeed, but he stopped and failed. Bell took up his work and carried it on to a successful result" (p. 545).

Again contrasting the work of Reis and that of Bell the Court says as to Bell's process patent:

> "His patent would be quite as good if he had actually used Reis' apparatus in developing the process for which it was granted" (p. 540).

With Bell's invention the practical art of telephony commenced. With the invention here in suit the practical art of

air-froth flotation ore concentration commenced. Both inventions were founded upon discoveries which took the final steps that converted experiment into solution, turned failure into success.

Froment Description.

This private document (printed, Vol. II, pp. 589-595; translation, pp. 595-600; drawings, pp. 815, 816) is in evidence in the Hyde case. It was very fully considered in the opinion of the District Court in the Hyde suit (207 Fed., 958-962), and this Court merely refers to it generally, saying "the Froment process was little more than a laboratory experiment and has never proved of value in practice" (242 U. S., 266).

In the Miami suit it was fully considered, upon "voluminous and conflicting" evidence, and dismissed by Judge Bradford (237 Fed., 626, 627). The Circuit Court of Appeals for the Third Circuit did not specifically refer to it.

The disclosures of this private description were fully presented and explained in the Hyde record, and upon that record this Court found no anticipation of the process in suit. In the instant case no demonstrations were made purporting to represent these disclosures, and there was no testimony of any moment in regard to them. It is, therefore, deemed unnecessary to again present arguments on this subject.

Cattermole Patents.

In the Hyde suit the defendant put in evidence the principal Cattermole patent No. 777,273 of December 13, 1904 (printed Vol. III, pp. 1280-1284). This patent was exhaustively considered in the Hyde case. It is briefly and accurately described in the opinion of the District Court in the Hyde case (207 Fed., 957, 958). It was referred to by this Court as one of the patents disclosing the advantage of the use of acid in addition to oil (242 U. S., 264), and selected as the example of the "metal-sinking process" (p. 265). It was again re-

ferred to by this Court as the process upon which the inventors of the process in suit were at work when they discovered the process in suit (p. 267). Obviously this Court has construed it as disclosing a metal-sinking process.

It is submitted that the opinion of this Court disposes of the arguments wherein the Cattermole process is erroneously represented as one in which an air-mineral froth is produced. Nevertheless in the instant case Judge Hunt compares the "froth" of the Cattermole process with the froth of the process in suit, and, avowedly interpreting the decision of this Court, says:

> "In the Cattermole process the *froth was held to be* distinguishable from the froth produced in the patented process," etc. (Vol. VI, p. 3108; Appendix to Petition, p. 37).

The persistence of this error would seem to require rather full consideration of the Cattermole process.

At the trial of the instant case defendant performed only one experiment alleged to represent the Cattermole process. It was a hybrid experiment in which Cattermole was not carried out, and the process of the patent in suit was spoiled by over-oiling. Oleic acid was the oily liquid used, the ore was defendant's, and the apparatus used was the Gabbett mixer. The oleic acid was 1½% on the ore (Dosenbach, Vol. IV, p. 1909, Qs82, 83), estimated at 7% on the low metalliferous content of the ore (p. 1910, Q94), which was about 20% (Q93), the zinc content being 14.8% (Q91). Agitation was carried on at 1450 revolutions per minute (p. 1911, Q102). This was a very high speed, 900 revolutions per minute being ample both for the Cattermole process and the process in suit and being the speed that was used in the Gabbett mixer when the process in suit was discovered (Higgins, Vol. V, p. 2509, Q358; Higgins Report of March 2, 1905, Vol. II, p. 651, *supra*, pp. 25, 26).

Mr. Dosenbach's experiment commenced with agitation at this unnecessarily high speed for six minutes (Dosenbach, Vol. IV, p. 1911, Q96). Upon stopping agitation, a low-grade aerated mineral float was formed (42.6% zinc; Defendant's Exhibit 304, Vol. VI, original paging 5543, following p. 3082). According to Cattermole the next proceedure should have been an upcast operation, which would have carried to waste with the gangue anything and everything that floated, and would have saved only the material which would sink in an up-current of water. In fact, in Cattermole, the procedures of agitation and upcast separation are successive, and are continuously carried on in succession. This procedure was not followed or even approximated. Agitation was resumed at the slow speed of 300 revolutions per minute, for five minutes (Vol. IV, pp. 1911, 1912, Qs103-105). As Mr. Dosenbach testifies (Q105):

> "It usually takes five to ten minutes to take the air out of there, out of the pulp."

This is what happened. The 300 revolutions per minute speed, useless in the Cattermole process, developed only an air-separating centrifugal action, and the air bubbles were so weakly attached to the mineral particles that they were readily separated by this centrifugal action. Upon stopping this slow agitation, there was practically no float (Qs106, 107).

Then the Gabbett mixer was speeded up again to 1450 revolutions per minute (Qs115, 116) and the result was a low-grade aerated mineral float, as before, but of lower grade, 40.7% zinc (Vol. VI, Defendant's Exhibit 304). Then the machine was again operated at the slow speed of 300 revolutions per minute, and the air bubbles again separated from the mineral particles (Vol. IV, p. 1913, Q126). Then the metalliferous mineral particles were separated in an upcast (*ib.*).

The result of this hybrid experiment was that the separated metalliferous mineral particles which sank in the upcast, to some extent agglomerated together, but not by any means into

well formed granules. The difference in specific gravity between mineral and gangue, about 4½ to 1½ (Higgins, Vol. V, p. 2507, Q332) was sufficient to account for the upcast separation without honestly carrying out the Cattermole process.

A comparison is instructive of the assay results of this alleged Cattermole experiment, final sunk concentrates 32.7% of zinc and 35.60% of insoluble or gangue, tailings 3.90% zinc (Defendant's Exhibit 304, Vol. VI, original paging 5543, following p. 3082) (78 pounds of zinc going to waste in each ton of tailings), with Mr. Higgins' genuine Cattermole experiment with the same ore, concentrates 56.63% of zinc and 2.53% of insoluble or gangue, tailings 1.99% zinc (Plaintiff's Exhibit 318, Vol. VI, original paging 5562, preceding p. 3087). Mr. Dosenbach's results show that he was not carrying on a metallurgical process, but merely juggling with hybrid conditions.

It is to be noted that in 1905 it was determined that for carrying on the Cattermole process

> "speeds of rotation (with a small Gabbett) varying from 3 [hundred] to 500 revolutions per minute proved almost useless" (Sulman & Picard Report March 3, 1905, Vol. II, p. 654),

and that Mr. Higgins' tests reported March 2, 1905, as to the effect of variations of speed in the Cattermole process covered a range of from 840 to 1462 revolutions per minute (Vol. II, p. 652). This speed of 840 revolutions per minute is the slowest speed described as producing any result in all of the Sulman and Picard and Higgins' reports. The defendant therefore in selecting 300 revolutions per minute as a speed for a Cattermole operation, selected a useless speed, and obtained in fact a centrifugal action for separating air bubbles from metalliferous mineral particles. And by increasing the amount of mineral-froth-forming oil to 1.5% on the ore he so weakened the attraction of air bubbles for the mineral particles that his aerated float was easily destructible.

Mr. Higgins properly criticises this experiment and says that it did not produce granules at all, but merely possibly some attachment between coarse mineral and fine mineral which might be called agglomeration, but in no sense granules (Vol. V, p. 2507, Qs329, 330), and that the centrifugal action resulting from the low speed produced centrifugal separation (Q331) and that the operation was not a carrying on of the Cattermole process (Q333). This was repeated in cross-examination (pp. 2623-2625, XQs145-173).

Mr. Higgins carried on the Cattermole process in a Gabbett mixer in accordance with the disclosures of the Cattermole patent, using a rather large percentage of oil, by reason of the very finely ground condition of the ore, 5% on the ore and about 15% on the metalliferous mineral (Vol. V, p. 2505, Qs315, 316). He stopped at the conclusion of the agitation to show that no froth was formed (p. 2506, Qs323, 324). The speed of revolution was about 850 revolutions per minute (p. 2505, Q315) and the recovery was 93.6% in a high grade concentrate containing 56.63% of zinc and only 2.53% of insoluble or gangue (Vol. VI, original paging 5562, preceding p. 3087).

Contrasting this experiment with Mr. Dosenbach's series of manipulations with 1½% of oil to ore (in the absence of the assays not then produced) he says that the results showed that for this operation in a single Gabbett and with a single upcast the proportion of 15% on the mineral and 5% on the ore was an excellent proportion to take (p. 2507, Q336) and that the production of the Cattermole result is the proper criterion for the determination of the right amount of oil to use (Qs337, 338) and that you cannot arrive at the proper proportion as a matter of mathematics because Cattermole gives his oil proportions as dependent on no less than seven different factors, and does not give the different rates at which the oil varies with these factors so that it is quite impossible to *calculate* the amount of oil you should use (Q340).

The statement that the Cattermole patents recommend a proportion of oil which, with lean ores, would be less than one per cent. of the ore, is and has been throughout the entire American litigation a favorite fiction of counsel for defendants, and this fiction is repeated in the Brief for Respondent filed in opposition to certiorari (pages 5, 6). The fact is that Cattermole directs the user to determine the proper amount of oil by actual tests, stating seven factors, viz: (1) viscosity of the oil, (2) fineness of the ore, (3) the nature of the metalliferous mineral in the ore, (4) the nature of the gangue in the ore, (5) the relative proportion of gangue to mineral (6) the consistency of mineral granules desired and (7) the size of mineral granules desired (Cattermole Specification, Vol. III, p. 1282, lines 63-65; lines 46-49; Higgins, Vol. V, p. 2508, Q340) and says that the proportion of oil should be "kept within reasonably low limits, differing in different cases," etc. (Vol. III, p. 1281, lines 9, 10). The standard of the art in his day was Elmore, requiring at least a ton of oil to a ton of ore. With all these qualifications, he suggests that usually an amount of oil varying from 4% to 6% of the metalliferous minerals will give suitable granules, but in the same paragraph mentions 10% as a proportion which will produce granules. Then he cautions the user that a lean ore *must be enriched* or in some way provided with an increased amount of metalliferous or other matter having an affinity for oil (p. 1283, lines 34-43). Obviously the only method of determining the proper amount of a given oil for use with a given ore, is that of trial, as Mr. Higgins testifies (Vol. V, pp. 2507, 2508, Qs337, 340). "Simple arithmetic," which defendant's counsel uses, based upon "assay values" (which show percentage of metal not of metalliferous mineral) or even based upon metalliferous mineral, is absurd. Mr. Higgins has found, as above noted, that with defendant's ore more finely ground than was usual in Cattermole's day (100 mesh) 15% on the metalliferous mineral (5% on the ore) gives excellent granules. There is no evidence that the defend-

ant's experts ever carried on the Cattermole process with any percentage of oil. In the Hyde case defendant's expert, Dr. Byrnes, merely theorized arithmetically. In the present case Mr. Dosenbach carried on an experiment that was not Cattermole and that did not produce granules. In practice the standard of the Cattermole process was 5% of the metalliferous mineral in an ore containing 55% of metalliferous mineral (Chapman, Vol. I, p. 224, Q9). This was 2.75% on the ore. In the laboratory the smallest amount ever used was 1½% on the ore.

The Circuit Court of Appeals in the Hyde case adopted defendant's argument that the Cattermole process consisted of two stages, first a violent agitation, which produced a froth, and then a slow smooth stirring, which sunk the mineral. This argument was ingeniously fabricated upon the facts that the Cattermole patent 777,273 shows a two-stage agitation (but with both stages of the same intensity, and an intermediate recovery of everything that sank and a loss of everything that floated), and that as the Cattermole process developed in the laboratory, it was found advantageous to employ a first and very violent agitation, which produced sinking granules, followed by a second and slower agitation which completed the conditions for final separation by sinking the granules (Chapman, Vol. I, p. 223, Q7). *In both instances, however, the agitation of the first stage was immediately followed by separation in an upcast which would have carried away to waste any mineral froth, and which saved for further use in the process only the material that sank in the upcast.* This is plainly apparent in the patent drawing (Vol. III, p. 1280) and is described in the specification (p. 1282, lines 8-24), and was specifically stated in the reports and by the witnesses. Mr. Chapman said (Vol. I, p. 223, Q7):

> "This first agitation was of a very violent type to bring about the oiling of the sulphide mineral. *The agitated pulp was then passed to a small glass upcast separator where*

> *the fine gangue slimes* [*as well as anything that floated*] *were washed from the pulp,* allowing only the oiled metalliferous particles and the coarse gangue [*which sank in the upcast*] to pass to the second stage of the process, which consisted of slowly rolling in the same type of mixer as used in the first stage, but with the baffles taken out and the speed of the cone much reduced."

And this was followed by a second and final upcast operation which again carried to waste with the gangue anything that floated.

The evidence also shows that in the final Cattermole experiments, made in the London laboratory while Mr. Chapman was in Australia installing the Cattermole process, it was found advantageous to do away with two-stage agitation, and to follow a single stage prolonged agitation by a single separation of sinking granules in an upcast (Sulman & Picard Report of Feb. 21, 1905, Vol. II, p. 648, par. 5). This was, however, never tried in practice as the Cattermole process failed in the mill and was abandoned before the knowledge of the invention in suit reached Australia and saved the venture.

An interesting experiment contrasting the process in suit and the Cattermole process was shown by Mr. Higgins at the trial. In a Gabbett mixer, at between 850 and 900 revolutions per minute, with defendant's ore and two pounds of oleic acid to the ton of ore, 0.1%, Mr. Higgins produced an excellent mineral froth (Vol. V, p. 2617, Qs84-86). Then he added 3.6%, 72 pounds to the ton of ore, of oleic acid, making a total of 3.7%, or 74 pounds to the ton (Q93), repeated the same agitation, and the froth was wholly destroyed and granules formed (Qs94-96). To show that high speed was not injurious Mr. Higgins then ran the machine at over 1500 revolutions per minute, but the result was just the same as at the lower speed. Excellent granules were removed from the bottom of the vessel which had taken up practically the whole of the metalliferous mineral (Q100).

This experiment presented the reverse of the operations which occurred at the time that the process in suit was dis-

covered. It showed the transition from the process of the patent in suit to the Cattermole process by substantial increase in the amount of oleic acid used.

It seems to have been impossible for some minds to conceive that there is any difference between a laboratory experiment, wherein a small amount of floating matter appears on the surface after stopping the agitation, and a process of concentrating ores in the mill wherein the mineral is concentrated by air-froth flotation. A small amount of floating material appeared at ~~the~~ times when the Cattermole process was being tested in the laboratory, usually the result of imperfect operation of the process, as where a part of the mineral was insufficiently oiled. Mr. Higgins referred to such a condition in his report of March 16, 1905 (Vol. II, p. 658), which occurred among the crucial experiments at the time of the birth of the invention. He said "6% of oleic acid on the mineral is sufficient to form good granules without much froth. This froth consists of *insufficiently oiled mineral* mixed with large quantities of air." Six per cent. on the mineral was three per cent. on the ore, as the report shows. In the table of results (p. 659) this experiment is described as "3% on the ore," "very little float." This float was of no metallurgical value, and Mr. Higgins, as the report shows, recognized and described it as a freakish operation, and immediately dropped down to 1.5% on the ore in the next experiment. He did not have a process of ore concentration by flotation until he dropped below 0.5% on the ore. During transition, by oil reduction, from the Cattermole metal-sinking process to the air-froth flotation process in suit, there are intermediate conditions which represent nothing and which are not of the slightest practical value. They do not represent processes of ore concentration. They cannot be magnified to practical proportions and carried out in the mill for the concentration of ores. We are dealing here only with practical processes of ore concentration, and the experimental freaks and useless intermediate conditions should be disregarded.

The Cattermole process was only at work for a few days in the mill. The oil consumption alarmed the mill owners, and Mr. Chapman had to spoil it and work a hybrid process wherein the mineral was separated on skin-flotation tables, with 0.8% of oleic acid to ore (Vol. I, p. 226, Q22). With this alteration, nevertheless, all of the metalliferous mineral that reached the tables had passed through two successive upcast separators wherein everything that floated was sent to waste, as appears from the description of the installation (p. 226, Q20). The Cattermole process was therefore a mill failure, as Judge Woolley described it in his opinion in the Miami case (244 Fed., 756, C. C. A., 3rd Circuit).

Cattermole patent No. 763,259 (printed Vol. II, pp. 744-749) is mentioned by defendant's expert, Dr. Sadtler, as stating the advantage of fine pulverization in the Cattermole process (Vol. III, p. 1633, Q7). The ability to treat slimes and the fact that the best results were obtained with fine grinding, were undoubtedly great advantages of the Cattermole process. As Mr. Higgins says the Cattermole process was "the first process to successfully concentrate slime material" (Vol. V, p. 2503, XQ290). It was characteristic of that process that

> "the finer the ore the more compact and cohesive are the granules formed from it" (Vol. II, p. 746),

as quoted by Dr. Sadtler in his testimony above referred to.

This patent happens to be the lowest numbered and one of the two earliest issued in the Cattermole series. It does not disclose a process of concentrating ores. It discloses a process for breaking down or disintegrating the sunken granules produced in the Cattermole ore-concentrating process, so as to obtain as separate products the sulphides of the different metals. It specifically refers to "Broken Hill ore" (Vol. II, p. 747) as the specific example of the ore the granules produced from which are to be thus treated.

Sulman & Picard Patent No. 793,808.

This patent issued July 4, 1905 (printed Vol. III, pp. 1289-1293), after the birth of the invention here in issue, but on an application filed October 5, 1903, when there was some hope of making something out of this *film or skin flotation* process. In the Hyde suit Dr. Byrnes misrepresented this process as a mineral-froth-producing process, testifying that he had reproduced the apparatus of Figure 1 of this patent, had used the revolving worm to produce a vigorous agitation, and had obtained a thick and satisfactory froth (Vol. II, pp. 922, 923). His apparatus was put in evidence and delivered to complainants, and they were unable to obtain these results and with repeated tests only produced skin flotation (Vol. I, pp. 388, 389), and Dr. Byrnes' evidence was further criticized (pp. 389-392). Defendant in the instant case has not altered this condition of the evidence.

At the trial of the instant case there was in behalf of defendant only a feeble reference to this patent as disclosing the use of gas bubbles for the purpose of floating metalliferous mineral particles to the surface of a pulp (Sadtler, Vol. III, p. 1632). This is in fact disclosed under conditions both as to the oil proportions described (from moistening the particles up to anything less than oil-buoyancy flotation) and general conditions of procedure such as inhibit froth formation. The air or gas bubbles, according to this process, escort the metalliferous mineral particles to the surface and leave them there.

Mr. Higgins briefly refers to this testimony of Dr. Sadtler (Vol. V, p. 2539, Q374). He says that in this process, where gaseous bubbles are used, they carry the mineral to the surface and burst, and the mineral either sinks or floats, like the greased needle, by skin flotation. He further says that there is in this patent no disclosure of any froth whatever. He further says that the specification also discloses flotation without the employment of any gaseous bubbles, and refers to the three

variations of apparatus shown in the drawings, each of which produces skin flotation (*ib*).

It may be noted generally that the patent discloses three general methods (1) flotation of oil-moistened particles where the oil is "insufficient to raise the oiled mineral by virtue of the flotation power of the oil alone" (Vol. III, p. 1292, Spec., p. 1, lines 25-28) without any description of apparatus; (2) flotation carried on in the apparatus of Fig. 1 wherein the mineral is oiled by carrying atomized or vaporized oil with air or gas into the pulp through perforations in a revolving worm; (3) flotation by spraying or throwing the oiled mineral upon the surface of water, carried on in the two varieties of apparatus shown in Figs. 2 and 3.

Although little was heard of this patent in the Hyde case after exposure of the erroneous testimony of Dr. Byrnes, it was relied upon in the Miami case, and Judge Bradford fully considers it and says that it "affords cogent circumstantial evidence of the patentability of the process of the first patent in suit" (the patent here in suit) (237 Fed., 628). The Circuit Court of Appeals of the Third Circuit also refers to this patent (244 Fed., 754, 767), and dismisses it either as an anticipation or as justifying the use by defendant of the Callow cell.

Kirby Patents.

There are two Kirby patents. The process patent No. 809,959 issued January 16, 1906 (printed Vol. III, pp. 1299-1307), on an application filed December 14, 1903, and the apparatus patent No. 838,626 issued December 18, 1906, on an application filed December 17, 1903 (printed Vol. III, pp. 1314-1318). Although these patents, and particularly the process patent, were fully considered in the Hyde case and prominently presented by the defendant there in the arguments before this Court, and were disposed of as anticipations by this Court, the defendant here has again presented them with an elaborateness far beyond any possible value that can be attached to them.

The evidence at the trial of the instant case exposed the character of deceptive experiments alleged to represent this process. The secret of the success of these operations in that they produced a floating magma or paste carrying a fair proportion of the mineral, was the presence of a soluble frothing agent contaminating the kerosene oil. This matter is fully considered under the heading, "The Kerosene Oil used in Defendants Court Experiments was Contaminated with Soluble Frothing Agent" (*supra*, pp. 141-143).

But this magma, however produced, is not a mineral-froth and is useless in the concentration of ores. Moreover, the conditions of terrific agitation under which it is produced were never dreamed of by Kirby. These experiments had nothing to do with Kirby's actual disclosure.

Kirby shows and describes an elaborate apparatus. Petitioners constructed this apparatus, in exact accordance with drawings (Higgins, Vol. V, p. 2489, Qs150-152). In that apparatus Mr. Higgins carried out the Kirby process with the Kirby ore, ore from the Rossland mine (p. 2489, Qs154-156), using the oil mixture of Kirby's example said to give the exact adhesive preference for that ore, this mixture being 95% of kerosene with 5% of semi-solid petroleum residuum (Q157), and using Kirby's minimum proportion of 25% of oil (Qs158, 159). This ore was crushed to 80 mesh, although undoubtedly Kirby used coarser crushing (p. 2493, Qs195, 196), but the finer crushing helped flotation. Acid was used because it improves the result and is suggested by Kirby (p. 2494, Qs201-204). Streams of oil and streams of air were flowed into the separating tank through the slowly moving agitator as described by Kirby (Qs206-208). The agitator in the mixing tank was rotated at a speed of 188 revolutions per minute (Q209) and in the separating tank at a speed of 30 revolutions per minute (Q210). Baffles were provided in the mixing tank, although not described by Kirby, because otherwise water would overflow from the vessel during mixing

(Qs211-213). The result of the operation was a thin layer of oil with mineral carried chiefly in the lower part of this layer and in fact at the oil-water interface, as described by Kirby (Q215). A peculiar phenomenon, described by Mr. Higgins as a crumpled up oil-water interface, resulted from the weight of the metalliferous particles and the disturbance caused by the passage of air through the pulp. This result was exhibited by pouring the overflow into a bottle, and it was seen that there was no mineral in the oil except at the interface (p. 496, Q224 et seq.). This was the Kirby result, not in any degree resembling a froth.

It is of interest that the experiment producing a crumpled up oil and water interface was first performed by defendant's witness, Professor Beach, demonstrating the greatly increased viscosity at such an interface and the presence of mineral particles at that interface added to that viscosity (Vol IV, pp. 1774, 1775, Qs29-35), and Mr. Higgins referred to that experiment (Vol. V, p. 2497, Qs232, 233). This scientific fact, demonstrated and confirmed by defendant's scientific experts, explains the possibility of carrying on the Kirby process with a thin oil. With Elmore's thick oil the viscosity of the oil holds the metal within the oil layer, although it tends to settle therein. But with Kirby's thin oil nothing but the increased viscosity of the interface prevents the metal from sinking to the bottom of the pulp, and the presence of metal there adds to the viscosity of the interface. As Kirby says in his specification (Vol III, p. 1304, Spec., p. 3, lines 55-58):

> "The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer, where it is in contact with the water,"

and the fact appears to be that all of the metal that Kirby succeeds in floating off is carried substantially at this oil-water interface. The recovery was not encouraging, being 36.4% (Vol. VI, original paging 5562, preceding page 3087), but the process was a failure anyway, and the reason for this is quite obvious.

Mr. Higgins explains the Kirby patents in connection with the experiments above referred to (Vol. V, p, 2488, Q138 et seq.).

Plaintiff's reproduction of the Kirby apparatus was not made in time for the Hyde case evidence. The Kirby ore was not available or used in the Hyde case. A full understanding of the Kirby phenomena was not attained in the Hyde case. The secret cause of the production of an aerated oily magma by terrific agitation with 25% of oil was wholly unknown to petitioners then. In the Hyde case there was no trial in open court. Dr. Byrnes had testified that he had obtained a froth with 25% of oil (Vol. II, pp. 920, 921), but petitioners' experts were unable to reproduce it (Vol. I, pp. 404, 405),

The reproduced Kirby apparatus, with the Kirby ore, was first used in evidence in the trial of the Miami case. At the argument of the Hyde case in this Court, upon the statement by petitioners' counsel as to the condition of the record, and with the consent of the Justices to showing an experiment not described in the record, the Kirby demonstration of the Miami suit was repeated in this Court in the Kirby apparatus, with the Kirby ore. The same experiment was repeated at the trial of the instant case, as above described.

California Journal of Technology.

This alleged anticipation was abandoned in the Circuit Court of Appeals. Should it require consideration in this Court the following will present the evidence.

The article first gives a brief outline of the Elmore process, described "now in successful operation" (Vol. VI, p. 2755).

An illustration is given of a large scale Elmore plant containing three agitating vessels and separating vessels (p. 2755), and this is described, and it is said that

> "Usually about a ton of oil is kept in operation for each ton of ore, but the losses of oil are small, the recovered oil being used over and over again" (p. 2756).

The oil described is "a heavy residuum of consistency of ordinary cylinder oil" (*ib.*). This is the Elmore oil, petroleum residuum, which is an inactive oil in the process in suit (Higgins, Vol. V, p. 2613, Q54). The method of recovering this oil from the concentrates by centrifugal separation is then described.

This is followed by a description entitled "Laboratory Methods" and here we have the first reference to the use of an agitation more violent, and an amount of oil much smaller, than that which characterizes the Elmore process. It is said (Vol. VI, p. 2757):

> "The charge may be agitated very gently, the oil being kept in a single lake and broken up as little as possible, consistent with a thorough contact of pulp and oil; or the charge may be agitated so violently as to dash *the oil* up into a foam or *froth full of air bubbles.*"

This latter was the new contribution of the students resulting in the production of a floating mass of oil full of air bubbles —an air-distended or spongy oil-and-metal paste or magma.

Later, under the same heading, this method of more violent agitation is again described as accomplished

> "By violently shaking the tube, thus producing the foam effect, or at least shattering *the oil into small globules*" (p. 2758).

Then follows a description of the floating off of the oil carrying the concentrate, the mineral laden oil, and this is applied as to three methods of agitation, the first and second being the gentle agitation of Elmore producing mineral laden oil without bubbles in it, or as the students well name it, the "lake effect," and the third being the violent agitation or what they call the "foam effect." Further it is said as to the product of all three methods of agitation:

> "The *mineral laden oil* is then heated and treated in the centrifugal separator as above described" (p. 2758).

Thus, without any question, whether the agitation is gentle or violent and the result the "lake effect," or "the foam effect," *mineral laden oil* is treated in the cylindrical or centrifugal separator to recover as much oil as possible; and also, as is stated in the preceding description, "the recovered oil being used over and over again" (p. 2756).

The advantages of an acid solution are then stated as (1) chemical action in dissolving oxide coatings, (2) increasing the specific gravity of the solution and thereby adding to the buoyant effect of the oil, and (3) particularly aiding the "foam effect" by generating gases, it being stated that the "foam effect" is

> "due to the generation of certain gases" (p. 2758).

This latter is not further explained, but all these advantages suggest the use of a very considerable amount of acid. No details are given, however, of any definite experiments with definite amounts of acid, or of the production of the "foam effect" by the use of acid or acidified water.

The advantage of the salt solution is then described, that by increasing the specific gravity of the water it multiplies the difference in gravity between the water and oil by three, thus giving the oil

> "a carrying capacity * * * threefold greater than with water alone" (p. 2759).

It is also said that the salt solution aids in producing the "foam effect," which they probably ascribed to its inherent tendency to foam (although it is not a mineral frothing agent) (Higgins, Vol. V, p. 2504, Qs302, 303).

Then comes the heading "Tests—Molybdenite Ore" (p. 2759). Here it is stated that the ore was of low grade with values fairly well disseminated and that the samples were crushed to 20, 30 and 40 mesh and treated in percolating tubes. Percolating tubes are glass laboratory test tubes with stoppered

bottom openings for draining their contents. Then follows a table giving details and results.

Experiment No. 1 is an Elmore experiment with 2,400 grammes of oil to 2,000 grammes of ore. The ore was crushed to 20 mesh, there were four treatments (the oil was extracted and used over again three times) and the recovery 6.3% was ridiculous. The text following says that this shows that the oil required

> "finer crushing to liberate the sulphide" (p. 2760).

Finer crushing was therefore resorted to, and experiment No. 2 was made with a sample crushed to 30 mesh. Here the recovery was much better, 67.6%.

Then experiment No. 3 was with the finest crushing, 40 mesh, and here the recovery was about the same, but the grade of concentrate fell off to the lowest in all of the experiments 17.4% of molybdenum sulphide. The comment on this is:

> "That although the finer crushing has freed the MoS_2 from the gangue, at the same time it has produced a larger percentage of fine gangue which, becoming mechanically occluded in the oil, gives a low grade concentrate" (p. 2760).

Thus these students rediscovered the well known fact that the Elmore process cannot treat slimes, and that 40 mesh crushing was too fine (it contained too much slime) and so they went back to 30 mesh and all of the other experiments in this table were with ore crushed to 30 mesh.

Experiment No. 4 is the first "foam effect" experiment, and in it they boldly cut down the oil percentage to 2.1%. Evidently they did not succeed in extracting enough oil for repeating the operation, as there was but one treatment, although their concentrate contained 75% of oil which would make a very good thin paste or magma (Higgins, Vol. V, p.

2503, Q293; p. 2504, Q301). The grade of concentrate was poor, 32.4% of molybdenum sulphide, and the recovery was hopeless, 43.5%. The experiments were made "in a salt solution" (p. 2760) and they therefore had the assistance of increase of oil buoyancy and of the natural tendency of salt water to foam. What they obtained in this and the other foam experiments they describe later as follows: "This throws *the oil* into a froth, which is heavily charged with air or gases. This gas, of course, gives a greatly increased buoyant force" (p. 2764).

In experiment No. 5 they more than doubled the amount of oil, using 5.3%, and here there were two treatments, as would be expected with the increased amount of oil. The recovery was only 47% and the grade the same, and thus the improvement was slight from experiment No. 2, but it was some improvement and therefore in experiment No. 6 they nearly doubled the oil, using 8.9% and three treatments, and secured a recovery of 75%. This is the only experiment upon which they favorably comment. They say (p. 2760): "In experiment No. 6 only about 10cc. of oil was used for 100 grams of ore. This gave an extraction of 75%, with concentrates running 32.4% MoS_2 [Molybdenum sulphide]."

But although the recovery was possibly a reasonable recovery, it is truthfully said that the concentrates were not marketable, and therefore they were reconcentrated, and in these reconcentration tests (7, 8, and 9 of the table) we have the only reference to the use of sulphuric acid, and it was evidently here used without further addition of oil in an agitation lasting fifteen minutes to cut out the gangue from the heavily oiled concentrate, and then followed by the addition of a further quantity of oil, apparently the 3% of the table, and a further agitation to float a concentrate of higher grade.

The remainder of the article deals with the Elmore lake effect, and much is said about tests of copper ores and gold ores, and it is very evident that if they had found that the

"foam effect," with its economy of oil (only 10cc. of oil for 100 grammes of ore, 8.9%, 178 lbs. of oil to the ton of ore, instead of 2,000 lbs. of oil to the ton of ore) could have been successfully used for copper or gold ores, the article would have described it. The conclusion moreover expresses the views of the students as to what they had discovered. They say:

> "The foam effect is best adapted for light, flaky minerals, such as molybdenite" (p. 2764).

Again they say that what happens is that the agitation

> "throws the *oil* into a froth, which is heavily charged with air or gases. This gas, of course, gives a greatly increased bouyant force. The *oil* in this condition assumes a certain load of mineral and holds it in a very stable condition" (p. 2764).

These interesting experiments did not add anything to the knowledge of the art that was of the slightest value toward the discovery of the process in suit. In fact *they point away from it. They were as guide posts pointing the wrong way.* The procedure which they carried on at 2.1% of oil was a failure, at 5.3% of oil was but slightly improved and also a failure, and at 8.9% of oil was alone worthy of consideration by metallurgists. The further investigations which their experiments suggest may be summed up as follows: (1) the use of oil at 8.9% and the avoidance of smaller proportions of oil; (2) the use of the Elmore oil, which has never been found to be a mineral-froth-forming oil but always inactive in the process in suit; (3) the use of salt solutions to increase, in fact multiply by three, the buoyancy of the oil; (4) crushing only to 30 mesh and the avoidance of slimes; (5) limitation of the foam effect to light, flaky metallic minerals such as molybdenite as contrasted with copper and gold. This leads far away from the invention in suit.

Mr. Higgins' testimony as to this publication explains the principal points above stated (Vol. V, pp. 2503-2505, Qs291-313; p. 2613, Q54). He says in part (p. 2503, Q292):

> "These experiments show in the first place such low extraction and such low values in concentrates that they are utterly worthless as metallurgical operations."

Mr. Higgins also says as to the three "foam effect" experiments 4, 5 and 6 of the table (p. 2504):

> "Q301. What is your understanding of what happens in these operations, experiments 4, 5 and 6?
> A. Well, with that quantity of oil to that quantity of concentrate there was a minimum of 75 per cent. of oil. That would make quite a nice thin paste, which has been described as a magma, and that magma would become distended with air bubbles introduced during agitation, and what we would have in the percolating tube would be the flotation of a magma distended with air bubbles."

Magma. The term "magma," which Froment so aptly uses to describe his float, is the appropriate descriptive word for the character of float produced both by the Froment patents and by the California Journal of Technology in its so-called "foam effect." The students describe their float as mineral-laden oil heavily charged with air or other gases, and say that it is the oil in the float which carries the mineral—"assumes a certain load of minerals and holds it in a very stable condition," etc. A magma is a paste, and the kind of magma produced in these operations is an inflated paste carrying metallic particles—a paste of oil and metal, inflated by air bubbles. It is like a cork lightened by the pores in it so that it has greater buoyancy. It is like a mass of soap made spongy by air bubbles, such as the ordinary floating soap of commerce and such as described in the Hyde Record under the heading "Flotant Soaps" (Vol. II, p. 1068). Specks of metal distributed through such a soap would correspond to the metallic particles in a mineral-laden magma. In such a

magma the metallic particles would be distributed through the viscous oily mass and not attached to the air bubbles at all, for air in oil has no attraction for metallic particles—an air bubble in oil will not pick up even the most minute particle of metallic dust (Vol. V, pp. 2525, 2526; pp. 2356, 2357, Qs44-47). The only function of an air bubble in a floating magma is to lighten the mass of oil and add to its buoyancy, so that a much smaller amount of oil than Elmore required will nevertheless float a fair amount of metal. Such a float resembles a mineral froth in external appearance, and in a a small glass vessel it looks quite like a froth, to the untrained eye, but it is essentially different in structure and infallibly identifiable by the trained eye; and it is useless in ore-concentration. It never got beyond the Froment laboratory test tube or the California students' laboratory percolating tubes.

The Froment process as this Court said, was "little more than a laboratory experiment" (242 U. S. 266). This disclosure was *nothing more than a laboratory experiment.*

Defendant in only one instance repeated an experiment resembling that described by the students, with 5.3% of the student's oil, a heavy petroleum, non-frothing. This experiment, with saturated salt solution (Vol. III, p. 1658 et seq.), appeared to produce what the students described, a floating mass of oil carrying metalliferous particles and heavily charged with air, in other words a magma. What the recovery was no one knows, but if it was as good as the students obtained, 53% of the metal was in the tailings. Defendant should have followed the instructions of the students and increased the amount of oil to 8.9%, 178 pounds to the ton of ore.

The other experiments of defendant alleged to show what these students had disclosed, clearly failed to do so. The other test-tube experiment with sulphuric acid and water heated to 40° Centigrade (104° Fahr.) was clearly unjustified. Sulphuric acid is not described as used in primary separation, but only for washing the gangue out of the concentrates, and whether

it is present or not in the final reconcentration does not clearly appear. However this may be, heating was clearly unjustified. The students were dealing primarily with the Elmore process, where heating thinned the oil and caused it to drop the metal, and there is not the faintest suggestion of the discovery made known in the patent in suit, that heat assist in the formation of a mineral froth. The advantage of heat in mineral froth formation is admitted by Professor Taggart (Vol. IV, p. 1728, Q49). The students avoided heat in their work of concentration because Elmore taught them to avoid it. They only used it after the concentration was completed and the concentrate separated from the gangue, to assist in separating the oil from the concentrate; and in such use of heat the heating of the oil is properly said

"to thin it and overcome its viscosity" (Vol. VI, p. 2756).

Defendant's Model Pyramid Machine. An experiment was carried on in Defendant's Exhibit 226, Model Pyramid Machine, with 2.1% of oil, alleged to be a repetition of what the students did.

It is only necessary, however, to consider the oil constituent to dismiss this experiment as in no way related to what the California students did. Defendant used its wonderful oil mixture (the product of years of study and research for means to evade the patent in suit), consisting of 70% of the students' oil, fuel oil or petroleum residuum, 12% of kerosene to thin this oil and thus impair its utility in the students' experiments, and 18% of pine oil, an essential oil, partly insoluble active frothing agent and partly soluble active frothing agent. Pine oil was therefore present in the proportion of 0.378% of the ore, part oily frothing agent and part soluble frothing agent. The other oils, fuel oil and kerosene, were inactive in froth formation. The only oily frothing agent present was the insoluble part of the pine oil. This was present in critical proportions amounting to a small fraction of one per cent. of

the ore. The presence of the soluble frothing agent made it possible to dump the inert oils into the pulp, 1.47% of fuel oil on the ore and 0.254% of kerosene, without spoiling the air-froth flotation process, and therefore the process of the patent in suit and the process of the solution patent (soluble frothing agent patent No. 962,678) could be carried on conjointly in this specially constructed model, with impaired but not impossible metallurgical results.

The procedure resembled that carried on in defendant's mill, except that in this specially constructed model it was possible to use more oil than in practical operations in defendants mill. The same ore was used with its abnormally large oil-absorbing clay gangue constituent. Cold water was used to solidify the grease constitutent. The agitation, although not that of a Janney machine, was abnormally intense, with a speed of 1988 revolutions per minute and a peripheral speed of 1561 peripheral feet per minute (Dosenbach, Vol. IV, p. 219, RXQ 188).

Mr. Higgins briefly states the reasons above given for his conclusion that the process was not that disclosed by the California students, and was a joint use of the process of the patent in suit and of the solution patent, impaired but not destroyed by excess oil (Vol. V, p. 2629, XQs198-207; p. 2633, RLQs240, 241).

Judge Bradford gave careful consideration to the disclosures of this California Journal of Technology, and held that it was suggestive, but led away from the invention, and did not anticipate it (237 Fed., 623). The Third Circuit Court of Appeals referred to it (244 Fed., 755), but dismissed it as non-anticipative. The District Judge in the instant case described it "as a suggestive but rather misleading and abandoned experiment sufficiently referred to and disposed of in the Miami suit" (Vol. I, p. 96).

Defendant's Large Scale Operations of No Probative Force for Anticipation.

All of the deceptive laboratory experiments misrepresenting the prior art made in behalf of the defendant in the Hyde suit having failed to convince this Court, the present defendant resorted to new tactics and we now have large scale operations and experiments carried on in the modern Janney machine in the light of all knowledge which the process in suit has given to the world and with agitation of an intensity far exceeding even petitioners' procedure, and these operations and experiments were put forward in the evidence as representing, indifferently, Everson, Froment, Kirby and the California Journal of Technology.

The allied infringing companies appear to have actually operated minor portions of their plants over a period of some months with a definite and persistent effort to use twenty pounds or more of oils to the ton of ore. The remarkable fact about these operations is that they approach so close to this artificial border line—indeed, many of them fail to overstep it. It is a patent fact that, however much may be at stake, no mill will carry on the flotation process in regular operations with an oil proportion exceeding one per cent. by any but a very small fraction of one per cent. and that in many instances these operations cannot be carried on at all, notwithstanding the presence of large amounts of ineffective oils, with aggregate oil proportions exceeding one per cent. This is notably true as to the slimes flotation plants at the Utah, both mills, Chino and Ray, of many times the capacity of the small retreatment plants in which efforts were made to maintain daily operations with twenty pounds or more of oil.

Another remarkable feature about all of these operations, whether regular operations or brief experiments, is that in every instance a soluble frothing agent is present, dissolved in the pulp, whether included in the oil feed or dissolved in the circuit water from former operations. It is the presence of a

soluble frothing agent which permits wasteful use of an ineffective oil without preventing mineral froth flotation.

The genesis of these operations is obviously not to be found in the prior art. Even defendant's expert Dr. Sadtler admits that they were made with improvements and knowledge and experience which followed the introduction of the process in suit into this country, as follows (Vol. IV, p. 2137):

> "XQ589. With improvements and knowledge and experience which have followed the introduction in this country of the process of the patent in suit, isn't that right?
> A. Yes; there has been an immense mass of experimental work done in all of the mills, which contribute to it."

The genesis of these operations is to be found in the patent in suit, but the further knowledge given to the world by the soluble frothing agents patent No. 962,678 on June 28, 1910, was necessary to the carrying on of these operations, since they all involve the use of soluble frothing agents.

It is interesting that even Mr. Dosenbach does not ascribe his knowledge of the possibility of using larger quantities of oil in air-froth flotation to the prior art, but ascribes it to the fact that in the Summer of 1913, in testing the process of the patent in suit for infringing operations at the Utah Copper Company, he stumbled accidentally upon the fact that with certain coal tars and coal tar derivatives alone and mixed with "the crude oils" (crude petroleums), it was necessary to use large quantities to obtain flotation results (Vol. IV, p. 1941, XQs 361-364; p. 1977, RQ610). Coal tar contains tar and oil and the soluble frothing agent phenol. The oil or part of it and the phenol are excellent mineral frothing agents. This appears to be true of all the tar oils, so that when used alone they contain all the elements of defendant's mixture, both the ineffective elements and the effective elements, the latter including the soluble frothing agents that permit wasteful amounts of ineffective oils to be used with impairment, but not prevention, of mineral-froth-formation.

The use of tar, grease and waxy substances is exceedingly convenient when the object is to increase the amount of useless material used under the name of oil. Examples of this are the use of a solid mineral wax Gilsonite, which looks like asphaltum, and contains only 56% of oil, as testified to by Mr. Thomas A. Janney (Vol. III, pp. 1542, 1543, XQs310-315), and the presence in the defendant's and other oil mixtures of grease which becomes semi-solid in the cold water used.

A consideration of the details of the many oil-wasting operations testified to in behalf of the defendant's is deemed here unnecessary. In so far as they were the actual operations of the defendant they have been considered under the heading of "Infringement." The operations of the other infringers so far as proved have been considered under their respective sub-headings under the general heading "Commercial Use of the Invention—Infringers." In only one instance were these operations other than those of defendant performed in the presence of petitioners' representatives, and that operation will now be considered.

Utah Copper Co.—Magna Plant—Oil Wasting Experiment. During the trial, on April 22, 1917, an operation was performed in the presence of petitioners' representatives wherein 21.8 pounds of oil (1.09%) were used per ton of material treated.

This operation is described by Professor Fulton and Messrs. Chapman and Greninger, petitioners' representatives.

There were seventeen Janney machines in series and in each machine an agitating compartment and two spitzkastens on opposite sides of the agitating compartment. From the spitzkastens floating material was discharged, while the tailings, deprived of the material which overflowed from the spitzkastens, passed on to the next machine (see flow sheet, Plaintiff's Exhibit 245, Vol. VI, p. 2974). As Mr. Conrads, metallurgical engineer of this plant admitted, the result was that each spitzkasten removed a large amount of oil and the oil proportion was stepped down from machine to machine (Vol. III, pp. 1594-1597, XQs381-414; see also *supra*, pp. 88, 89).

The double spitzkastens of each machine were practically duplicates, each receiving half of the agitated product of the admittedly "terrific agitation" (Conrads, p. 1594, XQ387) in the agitating compartment of the machine. The seventeen spitzkastens arranged in a row at one side of the machines may therefore be taken as representative of the other seventeen spitzkastens on the opposite sides of the machines, and this was accepted in the work of sampling, which was confined to one of the rows of spitzkastens.

In the exhibited operation the first spitzkasten was used as an oil collector and remover and thereafter the process proceeded without a troublesome excess of oil. The float in this first spitzkasten contained about 412.31 pounds of oil per ton (Deft's Ex. 251, Vol. VI, p. 2984). This float, as described by Professor Fulton, was mechanically divided on a plaque into (1) a floating oily emulsion carrying traces of mineral, (2) oil-air bubbles carrying a little mineral, and (3) the ordinary agitation froth, but in small amounts (Vol. V, p. 2444, Qs19-20). Mr. Chapman analyzed it on the plaque as containing (1) a collection of oil globules badly broken up with air, (2) a sunken oil slime, (3) oil globules easily separable from the settled slime, and this slime was like the sunken concentrate which could be vanned from the result of the agitation froth process (p. 2455, Q6). Mr. Greninger says that it separated into two distinct products, one being an oily emulsion containing oil globules and little mineral, and the other the mineral froth (pp. 2408, 2409, Q50). Mr. Chapman says that this first spitzkasten was really used for oil concentration (p. 2454, Q4). This oily float overflowed only at intervals, evidently to give the impression that the spitzkasten was out of use. Beyond this in the second and succeeding spitzkastens an air-froth carrying abundant mineral was discharged, and without question in 16 of the 17 machines the process of the patent in suit was being carried on in the presence of an amount of oil much less than 1% on the ore.

Professor Fulton's description of these operations (pp. 2443-2445, Qs13-29), further added to on cross-examination (pp.

2449-2452, XQs62-90). Mr. Chapman's description (pp. 2454-2457, Qs4-20; pp. 2465-2466, Qs81-86), also further added to on cross-examination (pp. 2466-2467), and Mr. Greninger's description of these operations (pp. 2408-2412, Qs48-89), which was also added to on cross-examination (pp. 2413-2416) are quite full and complete. Mr. Chapman testified as follows (p. 2465):—

> "Q81. Having before you all of these determinations, and having seen the plant in operation, I wish you would say what process was being carried on at the Utah Copper Company on the occasion of your visit.
>
> "A. The process employed at the time of our visit was undoubtedly that of the agitation froth process. The incident of that oil removal at the first spitz box, not being one of ore concentration, I would exclude that one box; but the rest of the plant was undoubtedly the agitation froth process."

Mr. Greninger testified that he considered the process which he there saw substantially the same as the standard Minerals Separation process with which he was familiar (pp. 2411, 2412, Qs83, 84).

The grease chilling phenomenon of the Butte & Superior process was here repeated, and a substance known as Calura was used in large quantities and undoubtedly assisted in presenting destruction of the process by the excess of oil.

It is impossible to consider this operation as representative of anything in the art prior to the process in suit. It merely shows what the ingenuity of an infringer may do when he wishes to use the process in suit and tries to mask it.

Moving Pictures.

These pictures were prepared and exhibited by Dr. William Mason Grosvenor, and the films are in evidence as Plaintiff's Exhibit 227. He testifies as to the care which he took to assure that the experiments represented were veritable ex-

periments by testing them over and over again, and were accurately portrayed in the pictures (Vol. V, p. 2596, Qs1, 2).

The explanation of these pictures (Vol. V, pp. 2511-2538) is full and complete. Briefly they show phenomena of actual occurrence and capable of this kind of picturing, which to some extent exhibit the operation of the forces at work in air-froth flotation, and they conclude with pictures actually showing the interior structures of an air-froth and an oil-froth or magma.

They are divided into scenes, which will now be briefly described, under their respective titles.

> "1. The strong attachment of unoiled or deoiled mineral particles for air bubbles. Four sizes—Galena—6 milligrams, 15 milligrams, 20 milligrams, 40 milligrams" (p. 2511).

Clean air bubbles immersed in pure water and held down by inverted cup shaped bubble holders are applied to these particles and the strength or weakness of attachment of the particles and these captive bubbles is exhibited by manipulation. All except the heaviest (40 mg.) particle have been oiled and then deoiled, under water, by prolonged bubbling of air to a film comparable with the adsorption film.

The 6 mg. particle is the heaviest galena particle which can be lifted by a captive air bubble gently manipulated and coated with oil to Cattermole proportions (8% on mineral). Particles thus coated will stick together by reason of their oil coatings—may be agglomerated into granules. This particle is seen to be instantly lifted. A very vigorous jerk is necessary to detach it from the bubble.

The 15 mg. particle is the maximum galena particle that can be lifted by the captive bubble with the utmost care if the oil layer is considerably reduced below this Cattermole thickness. This particle lifts instantly but is seen to be more easily detached than the 6 mg. particle.

The 20 mg. particle is the maximum that can be lifted by a free moving bubble when the oil layer is about one one-

hundred-thousandth of an inch thick. It lifts readily but a still less vigorous movement detaches it.

The 40 mg. particle is the maximum that can be lifted when clean or thoroughly deoiled. The lift is at first uncertain because of slight contamination of the bubble, and the particle is easily detached.

> "2. Oil globule fails to pick up even light metallic particles, air bubbles picks up similar particles many times as heavy" (p. 2513).

A large oil globule, made in and manipulated by the bubble holder under water attaches itself to and then breaks away from and fails to lift a galena particle weighing 5 mg. and an aluminum punching weighing 16.7 mg. A clean air bubble, similarly manipulated, picks up a galena particle weighing 30 mg. and an aluminum punching weighing 54 mg. The weakness of oil attachment to mineral in water as contrasted with air attachment to mineral in water is thus clearly shown.

> "3. Air bubbles do not readily attach themselves to oil globules and have slight, if any, lifting power when attached" (p. 2515).

A galena cube at the bottom of the vessel weighing 40 mg. has placed upon it a dome of oil. A captive air bubble is brought down in repeated contact with it. The oil flashes over the inner surface of the bubble, and forms a lens at the bottom of the bubble, but stretches out in a neck and breaks away as the bubble rises and the particle is not lifted. The air bubble robs it of part of its oil. The lifting force is the surface tension of the oil-water interface and is too weak to lift the particle.

> "4. Air bubbles do not attach themselves to metallic particles coated with sufficient oil to produce adhesiveness.
> "5. Air bubbles do not attach themselves to metallic particles coated with sufficient oil (cottonseed) to produce adhesiveness" (p. 2516).

Here we have a clean aluminum disc weighing 50 milligrams and two aluminum discs weighing 25 milligrams each and oiled to Cattermole proportions, that is with a layer which, with material ground to 80 mesh, would require between 4% and 8% of oil on the weight of the mineral and which produces a layer of oil about 30 one-hundred-thousandths of an inch thick. The captive air bubble lifts the heavy and clean particle and successively fails to lift the two lighter oiled particles. One oiled particle is lifted by tweezers and placed upon the other oiled particle and adheres to it so strongly that it is shown to lift it. Thus it is demonstrated that there is sufficient oil on the oiled particles to serve as a medium of attachment to other particles. The oil is the attaching medium. This is also true when air bubbles are applied to particles oiled in at least Cattermole proportions. The air bubbles do not attach themselves to the metallic particles, but the attachment is of the kind shown in the preceding pictures, experiment 3, wherein the oil flashed over and coated the inside of the bubble, and the attachment was that of the oil lining of the bubble to the oil coating of the particle, a weak oil neck attachment of little strength.

> "6. Air bubbles do not attach themselves to metallic particles coated with sufficient oil (oleic acid) to produce adhesiveness" (p. 2517).

This repeats the last experiment, with a change from cotton-seed oil to oleic acid.

> "7. The unlimited carrying power of air bubbles as compared with oil.
> "Air bubbles in water lift pieces of aluminum one inch in diameter, .05 inch thick" (p. 2517).

In this experiment a truly giant captive air bubble is held down by a large bubble holder and a magnified example is given of the direct attachment of a clean piece of metal for an air bubble. This experiment was performed in court (Vol. V, p.

2335; p. 2340). This particle weighs 1⅞ grams (p. 2517), but the increase in the size of the air bubble made it possible to lift it, and this shows that when air bubble and particle are both greatly increased in size, we may actually see the operation and measure the lifting forces, even though in the actual operation of the process both in the air bubbles and the metal particles are so minute as to be scarcely visible and the water so clouded by the gangue that very little can be seen. In the court experiment at first this large aluminum disc was not lifted, the laboratory conditions of cleanliness not being present (p. 2335). The particle was washed and thereafter was lifted (p. 2340), and it was clearly seen that the particle and bubble were directly attached and the clean metal surface, from which the water had retreated, exposed at the inner face of the bubble, although the particle being not quite clean there were a few little globules of water lying on the surface of the particle. In the pictured experiment laboratory conditions of cleanliness were observed and the fingers did not touch the disc. The giant bubble lifts the large disc, and it is seen to be firmly held, although swaying from side to side and bumping against the side of the bubble holder.

> "8. Same aluminum piece suspended by a fine thread lowered through water to show pliability of the thread" (p. 2518).

The title explains the pictures, wherein the large disc is lowered through the water and allowed to rest on supports at the bottom of the vessel, whereupon the threads sag, showing their pliability.

> "9. Same aluminum piece lowered through oil layer on water showing absence of oil-carrying power" (p. 2518).

The disc is lowered through a layer of oil, which fails to carry it, although it attaches to the particle, and draws out into a neck, giving an excellent illustration of the operation of the necking off of the body of oil as it fails to carry a metal particle.

"10. When air bubbles lifting metallic particles meet thinnest possible oil layer, they drop the particles" (p. 2520).

Here we have to the left a galena particle weighing 29 milligrams, in the middle a number of small galena particles of about 40 mesh, and to the right a punched aluminum disc weighing 54 milligrams. These are successively raised by clean bubbles and carried to the oil layer on the surface of the water, which is the thinnest layer it is possible to obtain. The moment the galena particle reaches the oil, its attraction for the air bubble is so diminished that it sinks. The 40-mesh particles are retained for a time by the oil layer, but sink in a mass like an inverted waterspout, illustrating overloading, just at the end of the experiment. The aluminum disc sinks as soon as it reaches the oil.

Microscopic examination of the pictures shows that the large galena particle sank in one-fourth of a second after the bubble had passed through the oil layer. A few of the fine particles immediately dropped, too quickly to be seen, and the others gather in a clot and hang for a few seconds. The aluminum disc quickly slid down to the lowest point on the oil film and fell without interruption to the bottom of the cell.

"11. Minute excess of oily mineral frothing agent causes air bubbles to drop metallic particle" (p. 2523).

Here a galena particle weighing 25 milligrams and an aluminum punching weighing 54 milligrams (each about one-half of the maximum lift) are successively lifted and suspended by captive air bubbles. A minute amount of oily frothy agent, three-tenths of a milligram, is then applied to the surface of each bubble. It flashes over the inner surface of the bubble, destroys the direct attachment of the bubble for the metal particle, and causes the metal particle to drop to the bottom of the vessel. Thus we see how oil acts as a robber of air bubbles and destroys the powerful direct attachment.

"12. Air will not attach to mineral enveloped in oil. Finely ground mineral particles less than 200 mesh (.0029 inches, .005mg.) are touched with air bubbles in pine oil, no lifting whatever" (p. 2525).

This experiment was also performed in court (pp. 2356, 2357, Qs44-47), and is very important as demonstrating that, in a mass of oil, air bubbles have no attachment or lifting power whatsoever for metal particles, even the finest metallic dust. It and the preceding experiments explain how useless air bubbles become in an oil layer, such for example as Kirby's, even though they may assist the buoyancy of oil particles to rise into the oil layer. The moment the surface tension of an oil-water interface, weak though it is, is no longer effective, and the metal particle is in a body of oil, all attraction of an air bubble and a metal particle is destroyed.

This experiment as pictured shows repeated applications of the air bubble to the fine metallic particles immersed in the oil without the faintest trace of attachment to the air bubble. Dr. Grosvenor also states that he has tested this with other oils and other minerals and it has given exactly the same result.

"13. Magnified view of clean air bubble in pine oil, no mineral attached" (p. 2525).

This picture shows the illuminated under surface of the bubble of the previous pictures taken immediately after it was last withdraw from contact with metal, and that there is not a speck of dust upon its surface.

It may be noted here that Professor Beach theoretically determined that under the conditions of these pictures the air bubble would pick up the metal particles and that the metal particles would add to the viscosity of the oil-air interface, this wholly erroneous theoretical determination being based upon his contact angle theory (Vol. IV, pp. 1793, 1794,

XQs144-146). This conclusion he reached after drawing diagram 20 (Defendant's Exhibit No. 147, Vol. VI, p. 2870), which well illustrated the uselessness of such theoretical deductions as defendant's scientific experts presented.

> "14. De-oiling of the galena particles. Kerosene rapidly removed. Three sizes shown in pine oil and water, 6 mg., 16 mg. and 20 mg." (p. 2526).

Experiments of this nature were performed in court (pp. 2337, 2340) and they show how intense agitation and aeration remove the oil from over-oiled metal particles. A stream of bubbles was played upon an immersed oiled particle and robbed the particle of its oil, and as the oil coating diminished the particle commenced to show activity, until finally the bubbles lifted the particle. In the court experiment the oil gathered on the surface of the water, and when the air bubbles lifted the particle it was re-oiled and had to again be de-oiled by air bubbles before the air bubbles could again lift it. The pictures well show de-oiling of the particles by the air bubbles and the increasing strong attachment for the air bubbles as the particles are de-oiled.

> "15, 16, 17, 18, 19. Magnified view of de-oiling 6 mg. particle from kerosene" (p. 2527).

The greatly magnified pictures well show the phenomena of the preceding experiment.

> "20. Agitation of water unmodified by a mineral frothing agent produces air bubbles which coalesce, rise and burst. Mineral frothing agents produce small and persistent air bubbles (p. 2527).
> "Unmodified water" (p. 2528).

Here it is observed that the moment the agitation is stopped the bubbles rise and disappear.

> "21. Magnified view of unmodified water" (p. 2528).

This experiment demonstrates how impossible air froth flotation is in pure water. The air is flowed into the water through a porous medium, alundum, with very fine pores, but the bubbles grow rapidly, coalescing with explosive violence, and the large bubbles are so weak that they do not even maintain spherical shape, but are extended horizontally into egg form. The rapidity of coalescence was so great that the normal rate of moving pictures, about 16 per second had to be changed to about 120 per second. These pictures were exhibited at about 12 per second, and thus it was possible by reason of the slowing down to see these operations of coalescence, or at least their results. Although these clean air bubbles have a strong attachment for metal particles, they would have about as much chance of remaining attached as a beetle of hanging on to a stick of exploding dynamite.

"22. Water modified by oleic acid" (p. 2530).

Here a minute amount of oleic acid has been added and the water modified thereby, and we see persistent minute bubbles capable of doing the work of froth flotation.

"23. Modified view of water modified by oleic acid" (p. 2530).

Here we can see not only minute persistent air bubbles, but cloudy masses of bubbles so minute that they cannot be individually seen. The striking difference between these pictures and those of bubbles formed in unmodified water under the same conditions enables us to comprehend how the modifying action of oleic acid produces useful metal-carrying air bubbles.

"24. Water modified by pine oil" (p. 2531).

Here we have a mineral frothing agent, partly oily frothing agent and partly soluble frothing agent, and we see the persistent minute air bubbles and the cloudy effects of bubbles too small to be individually seen.

"25. Magnified view water modified with pine oil" (p. 2531).

In this magnification we clearly see the typical smoky or forest fire effect of the extremely minute bubbles, as well as the persistency of those minute bubbles which are large enough to be seen as thus magnified.

"26. Kerosene oil not a frothing agent" (p. 2531).

Here first a minute amount, .05%, and then a larger amount, .49%, of kerosene was added to water. The bubbles rise quickly and burst, and the cloudiness is due only to emulsified oil—extremely minute oil globules—and not to air.

"27. Kerosene oil not aerating agent, but is itself emulsified" (p. 2532).

This is a view of the same emulsion after it has stood for an hour, and shows that the cloudiness is not due to fine air bubbles, but is due to oil emulsion, and these pictures well show the persistence of such an amulsion.

"28. Magnified view unmodified water in presence of kerosene oil" (p. 2532).

At first .05% of kerosene oil was added, then 5%. These magnified pictures clearly show large, quick-coalescing bubbles, just as in the case of pure water, and show how useless kerosene is as a mineral frothing agent.

"29. Pine oil excellent frothing agent with kerosene or alone" (p. 2532).

Here .1% of pine oil is added to the kerosene emulsion and now the agitation produces a wholly different result, fine and persistent bubbles being formed.

"30. Magnified view of water modified by pine oil in presence of kerosene" (p. 2532).

Here we see that the presence of the kerosene does not in any way interfere with the production of the fine clouds of bubbles or the forest fire effect as well as the persistent fine bubbles. The presence of the kerosene can hardly be said to modify this effect.

"31. Magnified view of water modified by pine oil in presence of kerosene and Jones fuel oil" (p. 2533).

Here we have substantially defendant's oil mixture, and the pine oil performs its modifying function just as it did alone, and just as it did in the presence of kerosene, the ineffective oils not having substantially changed the air bubble result.

"32. Water modified by phenol" (p. 2533).

This is the first set of pictures of a wholly soluble frothing agent. The extreme fineness of the air bubbles, producing cloud effects, is evident even in this not substantially magnified view.

"33. Magnified view of water modified by phenol" (p. 2533).

Here we have the forest fire effect and persistent minute bubbles which characterize all modifying agents. The effect is much the same with oleic acid, but there is a great improvement in the fineness of subdivision.

"34. Water modified by cresol" (p. 2534).

These pictures look quite the same as the unmagnified phenol pictures.

"35. Magnified view of water modified by cresol" (p. 2534).

These pictures look quite the same as the phenol magnified pictures, although there are recognizable differences, the smoke having a somewhat coarser granulation. The bubbles separately visibly are minute and persistent.

"36. Water modified by amyl acetate" (p. 2534).

This is the soluble frothing agent of the specific example of the soluble frothing agent, patent No. 962,678 and in this unmagnified view we have the same smoke effect as with the other soluble frothing agents.

"37. Magnified view of water modified by amyl acetate" (p. 2534).

The appearance of individual minute persistent bubbles and clouds of very fine bubbles is here quite the same as with phenol and cresol.

"38. Water modified by acetic acid" (p. 2535).

In this unmagnified view we have quite the same conditions as with the other soluble frothing agents. This substance, an excellent mineral frothing agent, is not an oil nor is it usually associated with oils and is most familiar as the dominating constituent of vinegar.

"39. Magnified view of water modified by acetic acid" (p. 2535).

Here we have the characteristic fine subdivision of the air and the ordinary characteristic of soluble frothing agents, with an excellent forest fire effect.

"40 Practical results. Air bubbles produced in modified water pick out metallic particles and reject gangue particles" (p. 2535).

Here the water is modified, containing .02% of cresol and .05% of sulphuric acid, and the effect of the captive bubble in

picking up metallic particles and rejecting gangue particles is shown. The metallic particles are galena (lead sulphide), pyrite (iron sulphide) and blende (zinc sulphide). The non-metallic particles are quartz, feldspar and calcite, typical gangue. The metallic particles are much the heavier, and the larger sizes and surfaces of gangue particles give the air bubble a better chance for attachment. The air bubbles seize upon the metallic particles one after another lift them and are detached only by violent jerks. The gangue particles are not lifted at all.

"41. Oil froths" (p. 2536).

The pictures show an oil emulsion froth or magma made with about 16 or 17% of oil to ore (p. 2599, XQ14), and show the interior structure of this floating material by light transmitted directly through it. It is mainly a mass of oil with metallic particles entrapped in it, and air bubbles are also entrapped in the oil, and as the floating mass is gently pressed and shifted between glass plates, these air bubbles escape and at the end of the experiment a sufficient number of these air bubbles has escaped to increase the density of the floating mass just above that of water and so it sinks. This well represents practical conditions where absolute quiescence of the water surface is impossible and the air bubbles that would be entangled and held in such a mass of oil and metal in a glass jar will escape and so diminish the buoyancy of the mass that it will not continue to float. The amount of oil is insufficient to float the entrapped metal by the buoyancy of the oil. The method of holding the metal particles is substantially the same as in an oil-buoyancy float.

The separate enlarged photographs of this film are in evidence as Plaintiffs' Exhibits 278-281 (0^1, 0^2, 0^3, 0^4, Vol. VI, pp. 3023-3026), the last showing the sinking mass now nearly deprived of air bubbles.

"42. Air froths" (p. 2537).

Here we have an air froth of the process in suit made with about 0.2% of oil to ore (p. 2599, XQs12-13), and illuminated in the same way as the oil froth, but manipulated much more violently.

In the moving pictures metal particles are seen dropping from the bubbles to which they are attached and being caught by other bubbles and the attachment of the metal particles to the air bubbles is quite clearly shown. The air bubbles are seen to act like rubber balls, squeezed together and catching and holding any falling metal particles. The effect of the agitation is a rearrangement of these bubbles. They persist in holding on to their metal particles notwithstanding the hard usage to which they are subjected. These pictures well show that in an air froth the metal particles are firmly gripped and held by the air bubbles just as the preceding pictures showed that with an oil froth or magma the metal particles are not held at all by the air bubbles; but that the air bubbles merely are weakly entrapped in a slippery mass of oil.

Five enlarged pictures of this portion of the film are in evidence as Plaintiffs' Exhibits 282-286, marked A1, A2, A3, A4, A5, respectively (Vol. VI, pp. 3027-3031). They show how the agitation has caused a complete rearrangement of the air bubbles without in any manner destroying the character of the structure, which remains a mass of air bubbles firmly carrying metal particles.

Defendant's Photographs of Froths and Magmas.

By way of offsetting the effect of petitioners' moving pictures, most of which were used in the Miami case and which undoubtedly helped the courts in that case, defendant prepared for and gave a magic lantern exhibition with external views of various froths and magmas shown by reflected light and successfully concealing the interior structures of the floats exhibited. As Dr. Grosvenor testifies the photographic work was

excellent, but the conditions chosen were such as to exhibit only surface similarity and give no information as to structure. Therefore in his opinion they were of no technical value whatsoever (Vol. V, p. 2597, Q4). About the only point made as to these photographs was that they in some instances showed two spots of reflection on the bubble, which was taken to indicate an unbroken inner surface of the bubble, but Dr. Grosvenor testified that in his investigations he has made hundreds, if not thousands, of photographs of the actual interiors of the bubbles, and that the principal difficulty that he has met with has been the great number of reflections (Q5). Mr. Higgins testifies that he has examined these photographs carefully and with magnification, and that they do not show a characteristic picture at all, and that he cannot see that they are of any use whatever (pp. 2608, Q2).

These floats were produced in a small glass jar with a bar mixer by Mr. Phillips, with oils largely supplied by defendant. Most of the photographs were taken of floats produced by defendant's wonderful oil mixture, or a modification of it, containing crude or fuel oil, kerosene and pine oil, and these, by reason of the presence of a soluble frothing agent, produced aerated floats with varying quantities of oil. The variations were from .4% to 1.5%. Mr. Phillips also used pine tar oil in variations from .4% to 2%, and this also contains soluble frothing agents (Higgins, p. 2608, Q9). Indeed it appears to have all the elements of defendant's mixture, and to function in the same manner. He also used wood tar oil with smaller variations, and this also contains soluble frothing agents (*ib*). He used California eucalyptus, which is an essential oil and contains soluble frothing agents (Qs5, 6), and which it may be added has never proved of any value in flotation, although the Australian Eucalyptus Amygdalina has been extensively used in Australia in the froth flotation process (Qs3, 4). With 25% of alleged kerosene he obtained a floating magma, but it later turned out that this kerosene was contaminated with pine oil, as fully set forth

herein under the heading "The Kerosene Oil Used in Defendant's Court Experiments was Contaminated with Soluble Frothing Agent" (*supra*, pp. 141-143). He also obtained a float with 5% of a smelter fuel oil with a very low grade flaky molybdenite ore, which float was in fact a magma (Q11). Whether or not this fuel oil was likewise contaminated does not appear, but it is certainly open to suspicion since it was obtained from defendant's plant where the oils are poured into tanks without regard to their previous contents and without cleaning the tanks, as testified to by Mr. Dosenbach (Vol. IV, p. 2187, XQs-149-151).

Mr. Phillips' speed of agitation was terrific. He thought it was about 1800 revolutions per minute, although he admitted that he did not know (Vol. IV, p. 1703, Q219), but Mr. Higgins measured it and found it was between 9,000 and 10,000 revolutions per minute (Higgins, Vol. V, p. 2544, Qs410, 411).

These experiments and photographs, even when not open to suspicion as to the purity of the materials used, were of no value whatsoever as to any question in issue herein, and the whole proceeding was a weak effort to offset the really instructive moving pictures shown in behalf of petitioners.

Opinion of Third Circuit Court of Appeals in the Miami Case.

This opinion was filed May 24, 1917, the case having been argued on January 30 and 31 and February 1, 2 and 3, 1917. It is reported in 244 Fed. 752. The opinion of the Court is by Judge Woolley concurred in by Judge McPherson. A partly dissenting opinion was filed by Judge Buffington.

At the time of the argument there no disclaimer as to claims 9, 10 and 11 had been filed and accordingly plaintiff's appeal there from the part of the decree below holding claim 9 invalid was abandoned, and that claim was thereby withdrawn from the consideration of the Circuit Court of Appeals.

No question of infringement having to do with the amount of oil used arose in the Miami case any more than in the Hyde

case, because the defendant used the minute fraction of one per cent. of oil to ore particularly recommended by the patent in the example given in it, and the patent was therefore not construed in that regard there. The whole question of infringement there turned on the character and degree of agitation employed by the defendant in that case. Consequently the question as to the quantity of oil involved in the process of the patent and the limitations in that regard, if any, of the claims of the patent was not in issue there and was not discussed there. The Circuit Court of Appeals for the Third Circuit in describing the making of the discovery says (pp. 755, 756):

> "In experiments with oil in proportions just under the Cattermole proportion nothing resulted. The Cattermole concentration was lost and no other concentration was obtained. When in the line of experiments, the proportion of oil to ore was reduced to 1.5 per cent. a 'float' appeared. At 1.04 per cent. still more float appeared. At .32 per cent. the 'float vastly increased.' At .10 per cent. the float again 'vastly increased.' It thus developed that in using oil at .10 per cent. or even at .05 per cent. on the ore, and after violently agitating the pulp from two and one-half to ten minutes, there arose to the surface when the pulp was brought to rest a thick froth or foam of oil-coated air bubbles carrying oil-coated metal particles to the extent of about 90 per cent. of the metal content, the foam being sufficiently stable to permit removal and metal recoveries.
>
> "This was an entirely new result based upon a phenomenon then unknown and still unexplained. It constituted discovery. It was a discovery that promised what has since been accomplished—a change in the art of oil flotation from laboratory experiments and mill failures to commercial success."

The Circuit Court of Appeals for the Third Circuit gives special attention throughout to that part of the decision of this Court which deals with the character and degree of agitation involved in the process; nevertheless, on page 758, and again on page 759, it points out that this Court laid down (p. 758) "the very definite limitation of the patent to *the*

results obtained by the use of oil within the described proportions, &c." (p. 759), "confining the patent to *the results obtained* by the use of oil in the critical proportions of less than 1 per cent."

It points out also, on page 758:

> "It is to be noted and kept in mind that the Supreme Court did not construe the patent or determine its scope, for it had no occasion to do so. In the case before it, infringement was so clear that it had to be found if the patent was valid. The validity of the patent, therefore, was the only seriously controverted issue before the Supreme Court."

On page 760, it says of the patent here in suit:

> "The elements of the patent in which invention is found are oil, air and agitation. These were old in the art. * * * But a finding by the Supreme Court that the invention was not anticipated by the old uses and results of these elements is in effect a finding that these elements as used in the process of the patent perform or *develop new uses and functions or produce different results.* And such we find to be the fact. * * *
>
> *Three* new uses of old elements are disclosed by the patent, producing a new result. The first relates to oil.
>
> The *affinity of oil* for metal was known, and though old, was employed in the invention; but that this *affinity* in a given condition *is greatest when its quantity is relatively least or that the affinity increases with the decrease of oil below a given quantity* (*less than* 1 *per cent.*) is the soul of the discovery and *was wholly new.* But the discovery did not consist of this alone. * * *
>
> The *agitation* of the patent does several things, old and new. It mixes the oil with the metal of the ore. This is old. Then by its *greater intensity and longer duration* it stirs the pulp into a froth, developing at once its own *new use as a frothing means* and still another *new function* of oil—that of a *frothing agent. Both are new.*
>
> But froth is made of *air* as well as oil. Air in bubbles is used for its old function of assisting or escorting metal

particles to the surface. But it is also used for the *entirely novel purpose* of supplying one of the essential elements of froth, *froth being the new result* intended.

Thus *oil* is used for its *newly discovered characteristics* of greater metal affinity when in minute quantity and *for its new function as a frothing agent; air* for the *new purpose* of supplying an element of froth; and *agitation* for its *new purpose* of bringing the two together and causing them to co-act and produce the *new result of a metal-carrying froth.* In other words, in so employing these old elements for new purposes, the new things which the patentees told the art are that a radical decrease of oil in conjunction with a radical increase of agitation develops to its highest potentiality the known affinity of oil for metal and produces a physical change in the pulp in the form of a froth by which metal recoveries are made possible and commercially profitable. The importance of these disclosures, scientifically and commercially, is manifest."

Thus the Circuit Court of Appeals for the Third Circuit gives emphatic endorsement to the finding of fact that the patentees of the patent in suit have obtained a result never before obtained, and by functions and operations that are novel, and by a process that required invention and is patentable.

In so far as the facts in the Miami suit resemble the facts in the instant case, it is to be noted that the defendant uses Callow pneumatic cells (called air-cells) for finally cleaning up or extracting the metalliferous mineral from the tailings in a pulp that has previously been agitated with a high degree of violence, and that the defendant has recently, and as an incident of the addition of ineffective oils, employed Janney mechanical-air machines as the fourth, fifth, sixth and seventh machines in each series of seven so-called pyramid machines. In these Janney mechanical-air machines the spitzkastens are provided with porous medium false bottoms through which air is discharged into the pulp to assist froth production, the pulp flowing into the spitzkasten directly from the agitating chamber wherein it has been subjected to the intense agitation which characterizes the Janney machine. On the other hand, in all

of the other Janney machines of the defendant the agitation in the agitating chamber is solely relied upon to effect the aeration of the pulp and the subsequent froth-flotation in the spitzkasten. Thus the defendant's practice well illustrates, separately and in combination, aeration by agitation and agitation by aeration, each type of machine producing and delivering a mineral froth—carrying on the process of the patent in suit and producing the new results first obtained by the process of the patent in suit.

These examples furnished by the operations of the defendant in the present suit of the use of pneumatic agitation alone in separate Callow machines and of pneumatic agitation combined with mechanical-aerating agitation in Janney pneumatic-mechanical machines, well illustrate the equivalency of mechanical and pneumatic agitation in carrying on the process in suit, and the District Court, with these example before it and other enlightenment from the present record and prior adjudications, expresses conclusions which well sum up the essentials of agitation and aeration for the process in suit. The District Court says, after particular consideration of the new scientific evidence (Vol. I, p. 95):

> "From these it is gathered that the mere introduction of particles of air into a liquid does not create bubbles, but that they are created by subsequent agitation, *either applied or self-agitation.* Air particles introduced into pure water are incapable of creating bubbles. The reasons are the surface tension of the water and the lack of viscosity to create a sufficient film about the air particle compel the escape of the air particles into the atmosphere and no bubble is formed. Some soaps and oils possess the quality to lessen this surface tension of water to give or increase this necessary viscosity. Their addition in appropriate quantity of water enables air particles introduced therein to create bubbles. Rather the meeting and coaction of water, oil and air, create a film composed of all three, and which surrounds the air particles. This film is more viscous than the mass of water, and rising to the surface, the tension of which (and of the films) has been

reduced by the oil, maintains itself as an air bubble. This quality of oil is of first importance in the process."

Later the District Court says (p. 96):—

"How the air particles are introduced into the pulp is immaterial. For introduced, they are still particles and not bubbles. Agitation subsequent to introduction is vital and alone can convert air particles into water-oil air bubbles. It is this subsequent agitation that within the claims of the patent agitates 'the mixture until the oil-coated mineral matter forms into a 'froth' or 'to form a froth.' And it is all one whether this be *applied agitation or self-agitation*—the agitation set up by the air particles themselves is merely rising through the mass and thereby coming in contact with both water and oil, all co-acting to form bubbles which capture the metal."

In the Miami case the defendant employed pneumatic agitation in Callow cells in what are described as the second and third processes, preceding it by agitation in other apparatus. In the Miami case the defendant contended that it did not infringe because the agitation that it employed was different in character from, and less in degree than, plaintiff's practice, and that the only invention plaintiff's patentees had made over the art resided in a stated kind and violence of agitation, and defendant there sought to have the court impose upon the patent a limitation to violent mechanical agitation. Indeed, defendant's argument there is exemplified in fruition in the dissenting opinion filed by Judge Buffington which went to the extent of asserting that the patent should not merely be limited to mechanical agitation and mechanical agitation by a Gabbet mixer but even by a particular kind of Gabbet mixer which was not shown in the patent and was in fact never used in the process. Defendant's argument there was that this Court itself had so defined the invention and limited the patent in the matter of agitation where it said (242 U. S., 265):

"and in so impregnating with air the mass of ore and water used, by agitation—'by beating the air into the mass'—as to cause to rise to the surface of the mass, or pulp, a froth," &c.

And again (p. 267):

> "air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself." &c.

And again (pp. 268, 269):

> "air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before."

Petitioners pointed out in reply in the Miami case that all of this was found in the part of the opinion that dealt with the process "as described and practiced" whereas in the concluding part of the opinion, where the only statement as to what "the patent must be confined to" is made—the only part of the opinion having to do in any sense with construction or limitation—no reference is made to this matter of agitation, either its character or its degree. This view was adopted by the Third Circuit Court of Appeals as to the statement of this Court first above quoted, which said of the defendant's argument in this regard (p. 758 of that opinion):

> "defendant misinterprets words of description as words of limitation";

and where, quoting from the opinion of this Court the first of the three statements quoted above, the Third Circuit Court of Appeals continues (pp. 758, 759):

> "By this expression the defendant maintains that the Supreme Court did not merely repeat testimony describing and showing how the process was practiced, but used the words as their own, and thereby interpreted the patent and limited its scope to the introduction of air into the pulp 'by beating the air' in the pulp by the specific mechanical means illustratively shown by the drawings of the patent. We do not so interpret this expression. In

> the first place the patent nowhere uses the words 'by beating the air in the mass'. Therefore these words, as quoted by the Supreme Court, were not quoted from the patent, but were taken from the testimony of a witness who used them in describing the process as discovered and developed by the patentees. This being so, we do not think these words, as used by the Supreme Court in describing the process, can be construed as a limitation upon the process."

The third statement above quoted from the decision of this Court, however, was treated as containing words of limitation, although not limitation to mechanical agitation. The Third Circuit Court of Appeals said (p. 759).

> "It further appears that the Supreme Court, in distinguishing the process of the patent from processes of other patents relied on as anticipations, found that the lifting force which separates metallic particles of the pulp from other substances resides chiefly 'in the bouyancy of the air bubbles introduced into the mixture *by an agitation greater and different than that which had been resorted to before.*' By this expression the defendant insists that the court explicitly limited the patent to agitation caused by mechanical means, thereby excluding from its scope such agitation by pneumatic means as was used in part in the defendant's practice. As this expression is susceptible of an entirely different meaning, presently to be considered, we find nothing said by the Supreme Court which indicates that it limited the agitation of the patent to agitation by mechanical means" (italics in original).

The Third Circuit Court of Appeals then quotes the concluding part of the opinion of this Court, where the statement is made as to what the patent must be confined to, and comments upon it as follows (p. 759):

> "We are inclined to the opinion that by this expression the court intended a limitation only upon that one feature of the patent to which the expression was addressed. The District Court had held valid certain claims in which

the proportion of oil was described simply as 'a small quantity,' and the Supreme Court in reversing that finding and holding those claims invalid, used the quoted words of limitation in confining the patent to the *results obtained* by the use of oil in the critical proportions of less than 1 per cent."

"From the recital of the litigation of the invention of the first patent it appears that in construing the claims of the patent we are greatly aided by the opinion of the Supreme Court in being told with authoritative finality that the process involves invention and in being shown in which of its elements invention resides; but it is equally clear that in determining the breadth and scope of the claims, we are without the aid of any adjudication in which their scope has been decided or even considered."

Certainly the patent in suit cannot be limited to a "beating in" of air into the pulp as contradistinguished from a drawing in or sucking in of air or a forcing in of air; for the apparatus disclosed in the patent in suit (a Gabbett cone mixer without beater arms) will not beat the air in. This Court must have been speaking of petitioners' commercial practice, and defendant Hyde's identical practice, as it explicitly stated on page 3 of its opinion. Petitioners' practice was then and is largely now to employ a propeller form of beater agitator, but that practice did not begin until 1907 or 1908 (Chapman, Vol. I, p. 228, Q27). Such a beater agitator is shown at "B" in the drawings of petitioners' soluble frothing agent patent No. 962,-678, dated June 28, 1910 (Vol. VI, p. 2920).

The Gabbett cone mixer shown at B in Fig. 1 of the drawings of the patent in suit introduces air into the pulp, not by beating it in, but by drawing or sucking it in. It does not even contain the inner ribs on the Gabbett cone shown in the drawings of the Gabbett patent (see Judge Buffington's dissenting opinion 244 Fed. 779; see also Gabbett patent, Vol. II, p. 726), as appears from Complainants' Exhibit cone mixer testified to by Mr. Higgins as a reproduction of the cone mixer used by him in the crucial experiments in 1905 at the birth of the invention (Vol.

I, p. 550, Qs23, 24). Judge Buffington apparently overlooked this exhibit, which was in evidence before him.

It is clear, therefore, that the introduction of air by drawing or sucking it into the pulp must be within the process.

The apparatus of Fig. 2 of the patent in suit which is described on page 2, line 103, to page 3, line 34 (and described there, as defendant's expert Dr. Byrnes, in the Hyde case, admitted, as a complete modified procedure commencing with the introduction of the ore into the water and ending with the separation of the froth, and described earlier in the specification as an alternative method for the retreatment of the tailings of the second and third spitzkasten of the apparatus of Fig. 1) introduces the air by forcing it into the pulp by a pressure of 50 to 100 pounds per square inch, sufficient to cause the air to be dissolved to a considerable extent in the pulp, the aeration and agitation being effected by the sudden relief of such pressure so that the air introduced by the pressure forms bubbles throughout the body of the pulp and sweeps to the surface

> "all the metalliferous matter in the form of a froth" (Spec., p. 2, line 115).
>
> "a coherent scum or froth" (Spec., p. 3, line 29).
>
> See also *supra*, pp. 25-29.

The patent in suit also discloses a method of distributing oil through an ore pulp and selectively coating the mineral particles with oil, which method requires only gentle agitation (*supra*, p. 35).

It is clear again, therefore, that the process cannot be limited to mechanical agitation or so as to exclude the introduction of air by pressure from without.

Indeed in the very nature of things it is immaterial how the air is introduced into the pulp, so that it be effectively introduced, and introduced into pulp containing a frothing agent, and so that mineral-holding air-froth be in fact thereby pro-

duced. The principles involved are the same. This is well stated by Professors Beach and Taggart, two of defendant's expert witnesses in the present suit, who studied the process of the patent in suit after it had attracted wide attention in the United States, and evolved a theory which Prof. Beach denominates the Beach-Taggart explanation of flotation. Their paper, published in Metallurgical and Chemical Engineering, a mining periodical, of November 1, 1916, after having been presented before the American Institute of Mining Engineers in September, 1916 (Vol. IV, p. 1742, XQs126-128), gives consideration to the pneumatic cell or air cell type of agitation and aeration and says:

> *"The principles involved in this method are the same as explained in the agitation-froth process. The only difference is in the method of introducing air.* The result of this difference is that the bubbles in the pulp are much larger than in the agitation-froth method; they arrive at the surface less heavily loaded in proportion to their weight. The bubble films are therefore less viscous and the froth less persistent" (Vol. IV, p. 1744, XQs136, 137; p. 1788, XQs112, 113).

What they refer to as the agitation-froth process, as repeatedly appears, is the carrying on of the process in suit with the type of agitation and aeration wherein air is introduced from above by agitation in one vessel and the froth is separated in another vessel.

Their statements, adopted by Professor Beach as

> "the result of my own observation" (p. 1788, XQ113),

are in this respect accurate. The only difference between mechanical agitation machines and pneumatically agitated machines, is in the method of introducing the air, and when we come to petitioners' subaeration machine, spoken of in this record as the Minerals Separation Hebbard machine, with air introduced into the pulp from below through a pipe and sub-

divided or beaten up by a revolving mechanical impeller, thi difference largely disappears. This Hebbard type machine i used at the Inspiration Consolidated Copper Company mill (*supra*, p. 78), and at other mills. The process of air-froth flotation ore concentration is the same process regardless of the variety of agitating and aerating apparatus in which it is carried on.

New York, N. Y., Feb. 26, 1919.

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ORN PAGES

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MINERALS SEPARATION, [redacted] MINERALS SEPARATION AMERICAN SYNDICATE [redacted] MINERALS SEPARATION NORTH AMERICAN [redacted] NATION,

[redacted]

vs.

BUTTE & SUPERIOR MINING COMPANY, [redacted] Butte & Superior Copper Company, [redacted]

[redacted]

On Certificate to the United States Circuit Court of Appeals for the [redacted]

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IN THE

Supreme Court of the United States

October Term, 1918.

No. 599.

MINERAL SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited,
Respondent.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

BRIEF FOR PETITIONERS.

This is a suit in equity, originating in the United States District Court for the District of Montana, for infringement of patent No. 835,120, issued November 6, 1906, to Sulman, Picard and Ballot, for a process of ore concentration.

In the case of Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, vs. James M. Hyde,

242 U. S., 261, this Court adjudged the validity and infringement of claims 1, 2, 3, 5, 6, 7 and 12 of this patent, and the invalidity of claims 9, 10 and 11. The invalidity of claims 9, 10 and 11 has since been cured by disclaimer. All of these claims are in issue in the instant case and upon acts of infringement in part the identical acts and in part continuations of the acts adjudicated against Hyde. The issues are therefore substantially the same as in the Hyde case.

This Court has decided that the patentees discovered a new process of ore concentration and that the prior art in no way disclosed an anticipation of the invention. No new evidence of prior art calling for a reconsideration of this conclusion of this Court has been presented. Indeed this conclusion is confirmed by the additional testimony in the instant case. It is established beyond question that the inventors were pioneers in the successful practice of ore concentration by air-froth flotation. The additional testimony also further confirms the conclusion of this Court as to the great value and importance of the invention.

In the Hyde case this Court decided that the patentees were entitled to the invention as described in the specification and pointed out in the claims adjudicated to be valid.

In the instant case the Circuit Court of Appeals first read into claims 1, 2, 3 and 12—the claims adjudicated by this Court to be valid which are not specifically limited to oleic acid (as are claims 5, 6 and 7)—*any and every oil or oily liquid* having a preferential affinity for metal or metalliferous mineral, *without regard to its capacity to perform the function required* by these claims (viz.: mineral-air-froth production by agitation), and contrary to the natural meaning of their language. The Circuit Court of Appeals then limited these claims to such a fraction of one per cent. as *shall not be more than one-half of one per cent.*, also contrary to the natural meaning of their language (viz.: a "fraction of one per cent. on the ore," the scope of which is at least everything less than one per cent.), thereby reducing the ambit of these

claims by 50%. Thus the way was opened to avoid the patent by mixing, for example, with two-tenths of one per cent. of an oil or oily liquid which, upon agitation, *will form a mineral-air-froth*, anything more than three-tenths of one per cent. of an oil or oily liquid which will *not* form a mineral-air-froth upon agitation. This is the procedure adopted by the defendant in its operations since the decision of this Court in the Hyde case, contended by it not to infringe the patent in suit, this contention having been upheld by the Circuit Court of Appeals.

Comparing these operations of defendant since the decision of this Court in the Hyde case with the admittedly infringing operations prior to such decision, there can be no doubt, and there is no dispute that the defendant, as Judge Bourquin, the trial judge said (Vol. I, p. 101),* "uses the same elements, in the same combination, in the same way with the same function to the same, but poorer, results." The contention of non-infringement is simply that defendant is using oils in excess of the amount alleged to have been imposed by the decision of this Court in the Hyde case as the maximum limit of the invention. Defendant admits that oil is wastefully and harmfully used, for no other purpose than to escape infringement, but interprets the decision of this Court to mean that the patent was declared valid solely on the ground that the invention consisted in a reduction in the amount of oil theretofore used in an old process, with marked pecuniary advantages, and was an improvement in degree but not in kind. This interpretation was adopted and applied by the Circuit Court of Appeals in the instant case.

The District Court, after a five weeks' trial in open court, decreed validity and infringement in favor of petitioners (plaintiffs), and directed on injunction and accounting in accordance with the prayer of the bill. Its decree may be summarized as follows:

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*The references in this brief will be to the Transcript of Record unless otherwise noted.

Unless otherwise noted, bracketed portions and italicizing in quotations will be petitioners'.

Validity as to all claims in issue, claims 1, 2, 3, 5, 6, 7 and 12, and 9, 10 and 11 as limited by disclaimer.

(1) *Infringement* of all claims in issue by defendant's operations to and including January 7, 1917. In these operations the defendant used a fraction of one per cent. on the ore of mineral-froth-forming oil—in fact less than one-half of one per cent. of mineral-froth-forming oil.

(2) *Infringement* of all claims in issue except the "oleic acid" claims (claims 5, 6 and 7) by defendant's operations since January 7, 1917. In these operations the defendant, as before, used a fraction of one per cent. on the ore of *mineral-froth-forming oil*—in fact less than one-half of one per cent. of mineral-froth-forming oil. But to this mineral-froth-forming oil it added a sufficient amount of oil that was *not* mineral-froth-forming to make the aggregate amount of oils fed into the pulp at all times more than one-half of one per cent. and eventually one per cent. on the ore or slightly more.

On defendant's appeal, the Circuit Court of Appeals, after argument, decreed the reversal of the decree of the District Court *in toto* and the dismissal of the bill upon a finding of non-infringment. The opinion of the Court, by Judge Ross stated that "it appears without dispute" that no acts such as described above under (1) had been committed, and the acts described above under (2) were held not to infringe. Defendant's counsel thereupon called the attention of the court to defendant's admissions in evidence, brief and arguments, that acts described above under (1) had been committed. The Court then, without further argument, entered and filed an order modifying the decree to affirm as to validity and to affirm as to infringement under (1), but to reverse as to infringement under (2); and the filed opinion of the Court, by Judge Ross, and the recorded and filed decree of the court, were thereupon altered in accordance therewith.

Three opinions were filed, one by each of the Judges of the Circuit Court of Appeals. The only issue of infringement dis-

cussed in these opinions was by acts described above under (2). The discussion purported to be an interpretation of the decision of this Court in the Hyde case, in the light of the evidence therein and of the arguments made before this Court therein. The evidence in the instant case was not referred to or discussed. On this issue of infringement the Circuit Court of Appeals divided. Judge Ross filed the opinion of the court, Judge Hunt filed a concurring opinion, and Judge Morrow filed an opinion concurring in part and dissenting in part. The opinion and decree of the Court confined the claims involved in infringement under (2) to one-half of one per cent. on the ore as the upper oil-quantity limit. Judge Morrow dissented as to this confinement of these claims. He held that this Court in the Hyde case had not so confined these claims, but that such confinement was to anything less than one per cent. on the ore.

The *fundamental error* of the Circuit Court of Appeals was that it reverted to and followed its own decision in the Hyde case as to the facts of the prior art and the relation of the invention in issue to that art, instead of following the contrary findings of fact and conclusions of this Court that caused the reversal of that decision. It purported to follow the decision of this Court in the Hyde case, imputing to this Court the findings and conclusions which it has enforced in the instant case.

From this fundamental error arose two specific errors of interpretation of the decision of this Court and of construction of the claims involved under (2) above.

First. That any oil or oily substance having a preferential affinity for metalliferous matter over gangue, is the oil or oily substance of the patent,

whether *it* be capable of performing the new operation and achieving the new results of the process, or not,

whether *it* be the equivalent in the process of the oleic acid given in example and illustration of the invention in the patent, or not,

whether with agitation *it* actually forms the mineral particles into a froth, as called for by all the claims, or not.

All three judges concurred as to this error.

Second. That all the claims of the patent are limited to an upper limit in the quantity of oil or oily liquid used, of one-half of one per cent. on the ore. In fact, however, the only claims so limited are the "oleic acid" claims (claims 5, 6 and 7). The other claims in issue are broad in this regard. This erroneous limitation is stated to be imposed because one-half of one per cent. on the ore was the upper oil-quantity limit that produced the new operation and the new results in the example given in the specification in illustration of the invention, namely: Broken Hill ore with oleic acid under specified conditions. This limitation was imposed in disregard of the direction and caution of the specification that each different ore and oil require tests to determine which oil and what quantity thereof will produce the desired results.

Judge Morrow dissented as to this error.

In applying the law as to infringement the Judges of the Circuit Court of Appeals, assuming that the substance of the invention as defined by this Court consisted merely in a reduction of the amount of oil used in an old process without change in principle of action or operation or results, had regard only to that one arbitrary feature and paid no attention to the new principle of action, the new operation and the new results described by this Court in its opinon. In consequence they *erred in their conclusions as to infringement.*

By reason of the bulk of the record herein, and the fact that many points in issue were decided by this Court in the Hyde case (the District Court record of which is in evidence herein, Vol. I, page 118—Vol. III, page 1334), petitioners have presented in this brief what appear to be the salient issues, and have prepared for ready reference a more complete and thorough consideration of the whole subject-matter in a supplemental brief, to which references will be made in this brief for full discussions and authorities.

Statement of Facts.

The patented process concentrates ores by air-froth flotation. To a pulp of finely ground ore and water a froth-forming oily substance is added in minute and critical amount, and upon agitation and aeration of the pulp a floating froth is formed consisting of air-bubbles carrying substantially all the metallic particles of the ore, which froth can be easily flowed off or removed. The valuable metallic particles are thus separated from the worthless earthy, rocky or gangue particles, and concentrates are obtained of the valuable metallic particles.

In the Hyde case (242 U. S., 261) this Court defined the invention, in contrast with the prior art, as that process of ore concentration by water, oil, agitation and aeration, which proceeds chiefly by an *air-lift* of the metallic particles (as contradistinguished from an oil-lift) and results in an *air-froth* holding the metallic particles in suspension above the pulp for separation (as contradistinguished from an oil-float).

As to the novelty of the patented process this Court said that *"it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery"* (page 266). This Court further adopted the statement of a witness that the process of the patent in suit *"produces a result never obtained before"* (page 268) and concluded *"that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical"* (page 269).

In the Hyde case infringement was so clearly evident that it was not discussed in the opinion, the whole subject being covered by the statement—"The evidence of infringement is clear" (242 U. S., 271). The defendant Hyde used oleic acid, which is the only oily froth-forming substance specifically named and specifically claimed (in claims 5, 6 and 7) in the patent in suit, and used it in the proportion of 0.16% on the

ore, which was well within the proportions of from 0.02% to 0.5% specified in those three specific claims. Therefore in the Hyde case no question arose as to what oily substances were included within the froth-forming oily substances capable of effectuating the process.

Nevertheless, as to the sufficiency of the disclosure in the patent of procedures "with different ores and different oily substances" (Spec. of Patent in suit, page 1, lines 63, 64), this Court said *"the composition of ores varies infinitely"* (242 U. S., 271); *"when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results"* (page 270); *"such variation of treatment must be within the scope of the claims"* (page 270); *"the range of treatment within the terms of the claims"* (page 271) is within the scope of the patent.

The defendant Hyde used mechanical devices to agitate and aerate the pulp, which were substantially the same as those used by petitioners when the testimony in the Hyde suit was taken, so that the process as "practiced," both by plaintiff and defendant, was practiced by the same mechanical means (242 U. S., 265).

In the instant case the earliest act of infringement is the identical act adjudicated in the Hyde case, presented by the identical evidence of that case, stipulated into the instant case. This earliest act of infringement was followed by a slight variation in the froth-forming oil used, pine oil being mixed with the oleic acid formerly used alone. Thereafter pine oil was used alone. In December, 1916, when the Hyde case was decided in this Court, the defendant had for two years ceased to use oleic acid and was using pine oil as the only froth-forming oily substance, in the proportions of 0.07% on the ore, and obtaining the best results it has ever obtained. Infringement by all of these operations, from August, 1911, to the end of the year 1916, was admitted.

On December 11, 1916, the opinion of this Court in the Hyde case was rendered. The hope of the defendant that this Court

would follow the Circuit Court of Appeals for the Ninth Circuit in declaring the patent invalid, was destroyed. The alternatives of submission to the adjudicated rights under the patent, or of attempted evasion of the patent, were presented. After preliminary experiments in the mill, defendant decided to pursue the course of evasion. For this purpose, and no other, commencing January 9, 1917, it added to the froth-forming pine oil which effectuated the process, a mixture of two petroleum oils, fuel oil and kerosene or equivalents, which separately or together were ineffectual to achieve the process, and it added these petroleum oils in such amounts that for a period of two months the total amount of all oils used, both froth-forming and non-froth-forming, was more than one-half of one per cent. and less than one per cent. on the ore; and thereafter, up to the time of the trial, April, 1917, the total amount of all oils used was slightly more than one per cent. on the ore. A slight increase in the amount of froth-forming oil, pine oil, was necessary to cope with this added non-froth-forming oil, but no other alteration was made in the procedure. This addition of non-froth-forming oils impaired the process, but did not otherwise alter it.

In December, 1916, defendant used pine oil alone at 0.07% on the ore. In January, 1917, the petroleum oils then added increased the total amount of all oils to 0.74% and the pine oil was slightly increased to 0.075%. In February, 1917, the total was increased to 0.97% and the pine oil to 0.095%. In March, 1917, the total was 1.11% and the pine oil 0.14%.* Thus the useful froth-forming oil was less than two-tenths of one per cent., although the total of all oils used was slightly

*The percentages above given follow the nomenclature of the patent in suit. With the American standard or short ton of 2,000 pounds, the range in pounds per ton of the pine oil in these operations was from 1.43 pounds (0.07%) in 1916 to 2.8 pounds (0.14%) in March, 1917; and the range of total oil proportions was from 1.43 pounds in 1916 to 22.08 pounds in March, 1917. With the American standard short ton one per cent. is twenty pounds to the ton, and one-tenth of one per cent., the recommended proportion in the patent in suit for oleic acid, is two pounds to the ton. With the British standard or long ton of 2,240 pounds the percentages corresponding to pounds per ton are diminished and the pounds per ton corresponding to percentages are increased.

more than one per cent. These operations are proved in detail, and that of March, 1917, may be taken as a monthly average of the extremes to which the defendant found it could carry its mill operations in its effort to evade the patent and yet utilize the patented invention.

In all these operations of the defendant the *variation* in the "critical proportions" of pine oil, the oil that effectuated the process, was less than one-tenth of one per cent. If any proof be necessary beyond what appeared in the Hyde case to establish that "critical proportions" of effective oils do exist, the defendant has clearly demonstrated it by the facts disclosed and proved as to its commercial operations during the period of excessive ineffective-oil additions to the ore pulp.

After the addition of fuel oil and kerosene and equivalents, the process remained identically the same in character, in mode of operation, in the factors that did the work, in the principles of action involved, and in the results obtained. Defendant did not alter the process, but merely impaired it, by the addition of the ineffective weight-making diluent oils, as was proved in the evidence and found by the trial judge.

Defendant has proved by its own operations that the addition of fuel oil and kerosene or equivalents to froth-forming oil so as to make the total amount of oils greater than one-half of one per cent., or greater than one per cent., impaired the operation and results of the process. That these particular petroleum oils, separately or together, cannot effectuate the patented process, is a large fact of the case, abundantly proved. In the world wide operations of the patented process since it was invented in 1905, no mill operations have ever been conducted wherein these oils (fuel oil and kerosene and equivalents) effectuated the process in suit, although they were and are the cheapest and were always available.

The substantive question of the instant case is, therefore, whether the patent in suit can be evaded by adding, to an oil that will effectuate the process, an oil which will not effectuate the process.

New Facts Not in Hyde Case.

The principal new facts in the instant case are the acts of infringement since the decision of this Court in the Hyde case—since December 11, 1916.

Operations of the character practiced by the defendant since that decision were wholly unknown prior thereto. These operations were devised by the defendant in its efforts to evade the patent and involve three essential elements, viz.:

(1) *A mineral-froth-forming oil* in the maximum proportion of about two-tenths of one per cent. on the ore; to wit, the insoluble part of pine oil.

(2) *Non-mineral-froth-forming oils, incapable of effectuating the process,* present in larger amounts, which amounts were eventually increased so that the total of all oils was one per cent. or slightly more: to wit, kerosene and fuel oil and equivalents.

(3) *A soluble mineral-frothing agent:* to wit, the soluble part of pine oil.

It is now known that the use of a *soluble mineral-frothing agent* makes it possible to add an excess of *ineffective oils* without preventing the operation of the process (Vol. V, p. 2612, Qs38-42). When the Hyde case was argued in this Court, it was in fact *wholly unknown to petitioners that ineffective oils could be used in excess and yet not prevent the operation of the process.*

The process employing soluble frothing agents is covered by petitioners' patent No. 962,678 of June 28, 1910, to Sulman, Greenway and Higgins. It effects ore concentration of the valuable metallic particles by air-froth flotation *without oil or oily liquid.* The frothing agents may be acetic acid (vinegar), alcohol, or certain other substances which are completely dissolved in the water of the pulp. The mineral-air froth is of

the same character as the froth of the process in suit, but the mineral particles are not oil-coated. It is an invention of petitioners later than the process in suit and its discovery was equally surprising. This solution patent was held valid and infringed by the Circuit Court of Appeals for the Third Circuit in Minerals Separation, Ltd., vs. Miami Copper Co., 244 Fed., 752, affirming in this respect the decision of Judge Bradford of the District of Delaware, 237 Fed., 609. This solution patent is not in suit here. When petitioners *discovered this additional infringement,* leave was requested to include this solution patent in issue, but the trial was then in progress and defendant's objection controlled (Vol. IV, pp. 2068, 2069). This solution patent is in evidence herein (Defendant's Exhibit 218, Vol. VI, p. 2920, original paging 5274) and is explained in evidence, and it is proved and not denied that the conjoint use of this solution process with the process in suit enables the defendant to use large amounts of ineffective oils (Higgins, Vol. V, pp. 2539-2543, Qs377-403; p. 2612, Qs39-42; Sadtler, Vol. IV, pp. 2120, 2121, Qs508-514).

The solution patent was known at the time of the argument of the Hyde case in this Court, but its process was not used by the defendant Hyde, and it was not in evidence and was in no way involved in the Hyde case. It is a characteristic of this solution process of ore concentration that *a minute amount* of such petroleum oils as the defendant uses in the instant case, performs a useful auxiliary function in connection with this process, tending to prevent coarser mineral from falling out of the mineral air-froths formed by these soluble frothing agents. These petroleum oils do not form the froth, *but they help it hold coarser mineral* (Vol. V, p. 2612, Q42). This was known at the time of the argument in the Hyde case, but was irrelevant to the issues therein. In anything above these minute amounts these petroleum oils are inert, useless and injurious. This was also generally known at the time of the Hyde argument, but the extent to which the injurious effect of an excess of these petroleum oils could be overcome by soluble froth-

ing agents was not known to petitioners then. No practical process of air-froth flotation had been carried on prior to the argument in the Hyde case wherein oils or oily liquids had been used in excess of a fraction of one per cent. on the ore. It may be added that no practical process of ore concentration has since been carried on using more than a fraction of one per cent. *of mineral-froth-forming oils or oily liquids.*

The joint use of oily mineral-froth-forming agents and soluble mineral-froth-forming agents was known and practiced at the time of the Hyde argument, but was of no relevancy in that case.

In the Hyde case there was evidence of the use of fuel oil, *in minute amount*, with a soluble frothing agent and an oily frothing agent, viz.: at the Braden mine in Chili. The frothing agent used was a mixture of three pounds of Texas fuel oil with one pound of American wood tar oil to the long ton of ore (Vol. I, p. 245, Q112), or expressed in percentages 0.135% of fuel oil and 0.045% of wood tar oil. The total amount of oils used was 0.18%, less than two-tenths of one per cent. The minute amount of fuel oil (less than one-seventh of one per cent.) with the soluble part of wood tar oil, which is a soluble frothing agent, and the insoluble part of wood tar oil, which is an oily frothing agent (Vol. V, p. 2608, Q9), gave good results with Braden ore. The minute amount of fuel oil there used acted to prevent coarser metallic particles from falling out of the froth and thereby obviated the necessity of the very finest grinding, with resultant economy in the cost of grinding the ore. These details were also irrelevant in the Hyde case. Only the general facts were proved, establishing that the Braden mine, under license of the patentees, had successfully tested the process in suit and was then installing it.

In the Brief for Respondent opposing the Petition for Writ of Certiorari, a fallacious argument is presented to sustain the erroneous contention that the petroleum constituents of defendant's mixture should be included as "oil" of the patent,

by referring to the above described and similar uses, of fuel oil, kerosene and equivalents, *in minute amounts* and associated *with soluble frothing agents.* This subject is fully treated in petitioners' Supplemental Brief, pp. 127-140).

A surprising new fact appeared in the instant case. It was proved that in a small laboratory vessel, with twenty-five per cent. of kerosene oil (500 pounds to the ton of ore) *contaminated with a minute amount of soluble frothing agent,* upon intense agitation, a floating aerated paste or magma could be produced which looked like a mineral-air-froth (although wholly different in structure and practically useless in ore concentration) and which carried a fair amount of mineral. It was also proved that this was not possible when the kerosene oil was not thus contaminated (Supplemental Brief for Petitioners pp. 141-143).

Since the decision of this Court on December 11, 1916, the defendant, in addition to using mechanical devices for agitating and aerating the ore pulp, has employed pneumatic means for agitating and aerating the pulp, by the method known as subaeration. Here the air instead of being drawn into the pulp from above, by agitation, is forced into the pulp at the bottom, and suitable means are provided for assuring its delivery into the pulp in finely divided condition. The defendant employs a froth-separating vessel having a porous false bottom through which air is forced under a pressure of a few pounds. The air thus forced in becomes the medium for agitating the pulp as well as aerating the pulp, and the presence of a modifying agent (mineral-froth-forming oil) under these conditions assures mineral-froth formation. The air forced into the pulp agitates the pulp to form the froth. Judge Bourquin aptly describes this as "self-agitation" (see quotations on next page).

In this part of its operations defendant employs the same froth-forming and separating mechanical device as was employed by the defendant in the Miami suit, to wit, the so-called Callow pneumatic cell, the operation of which was fully dis-

cussed, and led to a disagreement in the Third Circuit Court of Appeals as to limitations which the judges of that court believed had been placed by this Court in the Hyde case on the meaning of the words "agitating the mixture" which appear in all of the claims in issue (majority opinion by Judge Woolley, concurred in by Judge McPherson, 244 Fed., 752; dissenting opinion by Judge Buffington p. 775).

In the instant case the trial judge, Judge Bourquin, in discussing the process in suit says (Vol. I, p. 96):

> "How the air particles are introduced into the pulp is immaterial. For introduced, they are still particles and not bubbles. Agitation subsequent to introduction is vital and alone can convert air particles into water-oil-air bubbles. It is this subsequent agitation that within the claims of the patent agitates 'the mixture until the oil-coated mineral matter forms into a froth' or 'to form a froth.' And it is all one whether this be applied agitation or *self-agitation*—the agitation set up by the air particles themselves in merely rising through the mass and thereby coming in contact with both water and oil, all co-acting to form bubbles which capture the metal."

And again Judge Bourquin says that (p. 95):

> "the mere introduction of particles of air into a liquid does not create bubbles, but that they are created by subsequent agitation, either applied or *self-agitation*."

In the Miami case the dissenting opinion was founded upon the belief that this Court had limited the patent in suit to *a particular type of mechanical agitation*, solely because in the Hyde case the practice, when the testimony was taken, both of the plaintiffs and the defendant was of that type, and this Court described that type of agitation as "practised" (242 U. S., 265). Even the prevailing opinion in the Miami case puts forth views as to what this Court meant as to agitation which petitioners believe are more limited than they should

have been. This subject is fully discussed in the Supplemental Brief, pp. 199-210).

Other new facts in the instant case since the taking of testimony in the Hyde case, are the wide extension of the use of the process in suit, by petitioners' licensees, in operations of great magnitude; and also, by allies of the defendant, who, in defiance of the patent, adopted the same policy of evasion as the defendant in the minor portions of their flotation plants. The operations in the major portions of their flotation plants with minute amounts of oil, as formerly, were continued. These operations are proved by the defendant.

There is additional evidence as to the prior art which only confirms the conclusions of this Court in the Hyde case.

There is also additional scientific evidence, mainly offered by the defendant, which although largely in the domain of hypothesis, likewise confirms the conclusions of this Court.

Essential Issues.

The essential issues of the instant case are:—

(1) does the invention as described and claimed in the patent in suit include any and every oil or oily liquid having a preferential affinity for metalliferous matter over gangue, whether capable of effectuating the process or not, and

(2) is the invention described and claimed in the patent in suit limited, in every instance, with every ore and every oil and every oily liquid, to the use of not more than one-half of one per cent. of oil or oily liquid?

These two points are later considered under the heading "Errors of Circuit Court of Appeals" (*infra* pp. 65-85), but the first point is of such vital importance, and the evidence in relation to it has been so erroneously presented to this Court in the Brief for Respondent in opposition to the Petition for the Writ of Certiorari, that important and controlling facts in relation to it will be here considered.

The importance of determining whether the patent in suit, in speaking of "oils, fatty acids, or other substances which

have a preferential affinity for metalliferous matter over gangue" (Vol. II, p. 565, spec. p. 1, lines 12-15), included only such oils and other substances (the other substances being required to have the preferential affinity for metalliferous matter which characterizes all oils) as *would* effectuate the process, and excluded such oils and other substances as *would not* effectuate the process, is absolutely vital to the value of the patented process. If all oils, and all other oily substances having a preferential affinity for metalliferous matter are included, regardless of how they function, the patented process becomes valueless no matter what limitation or extension is put on the amount of oil or oily substance used. Evasion would be simple, as was proved in the instant case.

Judge Bourquin says in this connection (Vol. I, p. 101):

> "Defendant uses the patent process, uses plaintiff's invention of ore concentration by air bubble flotation, uses the same elements in the same combination in the same way with the same function to the same, but poorer results; and exceeding the patent claims in reference to one ingredient (oil) *uselessly, wastefully and injuriously* and *merely with intent to avoid the letter of the patent* does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process."

What is this special and new function of oil that the patentees first discovered and put into commercial use? This is definitely and clearly stated in the specification and in all the claims in issue. "Upon agitating the mixture" a metal-bearing "froth" is formed and carries a large percentage of the metalliferous mineral values to the top. At the trial, scientists advanced conflicting theories in endeavoring to explain this phenomenon, but there was a consensus of opinion that with a suitable oil, in a mixture of ore and water, the amount of this suitable oil being a small fraction of one per cent. on the ore, the air bubbles introduced into the mixture by mechanical means or otherwise, are *modified.*

The operation of the process starts with an ore pulp, a mass of finely ground ore diffused in water, a muddy liquor. The ore consists of particles of worthless dirt or rock or gangue and of valuable particles of metalliferous mineral. They have been separated by grinding, and they are diffused through this ore pulp, which is kept in motion so that they do not settle. The oily modifying agent is added. Air is introduced into this mass of ore pulp and is broken up into air cells or submerged air bubbles. These bubbles, modified by the oily agent, course through the liquid, pick out or select the valuable mineral particles, rejecting the gangue particles, firmly attach to themselves the mineral particles and carry them up through the pulp and form upon the surface of the pulp a floating froth layer loaded with metalliferous mineral. This is the essence of the operation of the process.

Why does it thus operate?

When air is introduced into an ore pulp containing an oily modifying agent, then, upon such agitation as would bring the submerged air bubbles into contact with the oiled particles, the air bubbles very firmly attach to themselves the mineral particles, reject the gangue particles, and float the mineral particles upward. The oily modifying agent must, however, be such an oil or oily liquid as, with the ore used, will so modify the air bubbles and so make and maintain the integrity of bubbles that as they course through the liquid they pick out and firmly attach to themselves the mineral particles and reject the gangue particles and buoy up the mineral particles, and as soon as they are given an opportunity to do so they rise up through the pulp, carrying their load of mineral particles, and emerge from the liquid as air bubbles having thin oil-modified liquid films holding the mineral particles, and they accumulate upon the surface into a floating froth layer which carries the mineral particles. This froth layer may vary from a fraction of an inch to several inches in thickness.

On the other hand, when air is introduced into an ore pulp which does not contain a modifying agent, this bubble-modifying

action is wholly absent, and when submerged bubbles reach the surface they burst or explode and no froth is formed and no concentration is effected.

The operation last described takes place whether the pulp consists of ore and water only or has added thereto an oily liquid or other substance which does not exercise the modifying action essential to mineral-froth formation.

The bubbles in the mineral-carrying froth which results from the operation of the process in suit are so persistent and so firmly grip the mineral particles, that they may be separated from the water on which they float without dropping the mineral particles; usually by simply overflowing a dam.

The mineral froth is most persistent when it is heavily charged with mineral and is allowed to float over a quiescent surface. The air bubbles carrying the metallic particles form a floating mass of heavily armored bubbles pressed against each other, constituting a coherent mass of froth, which may be inches thick upon the surface of the pulp. Such a froth may float for days and even weeks. A quiescent froth of this character has therefore been called a persistent or permanent froth.

On the other hand, if the froth is not quiescent, the ore is poor in mineral, and an excess of air is introduced, the froth loses in persistency. As, for instance, the air bubbles which carry the metallic particles may be continuously flowed over a lip or dam, pressed upward by newly rising air bubbles which are introduced for the purpose of agitating the pulp. Such a froth was produced by the defendant in the Miami case, and is produced by the defendant in the instant case, in similar apparatus, known as Callow or pneumatic cells, now used for the final treatment of the tailings.

A wide range of opportunity is therefore afforded for the collection of the metallic particles selected and lifted by the air bubbles, and as the patent says, the froth may be "removed from the pulp by spitzkast, upcast, skimming, draining or otherwise" (Spec., p. 2, lines 1-3).

In the Hyde case this Court said, describing the birth of the invention (242 U. S., 267):

"This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used."

When the air bubbles are *modified* by the oil or oily liquid used, the process is effectuated. If the oil or oily liquid does not modify the air bubbles, it does not bring about the operation of the process. It is extraneous material, alien to the process.

Defendant attempts to justify its contention that all oils and oily substances having a preferential affinity for metalliferous mineral are to be included as oils of the patent, by asserting that the essential function of the oils described in the patent is their preferential affinity for metalliferous matter, and then concluding that if the substance used has this characteristic it is *ipso facto* an oil or oily substance of the patent.

But this wholly misconceives the novel and essential function of the oil as set out in the patent and its claims and in the opinion of this Court, namely its bubble-making and bubble-modifying function. And it tacitly admits the fact as to the fuel oil and kerosene used by defendant that they do not have that function. For there is abundant evidence in the testimony of defendant's own witnesses that there are many oils that are incapable of producing metal-carrying air-froths, no matter in what proportion the oil is added to the ore pulp. Defendant's witness, Thomas A. Janney, admits of knowing "a great number of oils that in themselves do not possess the properties of creating froth when they are agitated" and "another class of oils which I call frothing agents, which are capable of producing froth" (Vol. III, p. 1526, Q158). Professor Bancroft, one of defendant's scientific witnesses, says that "kerosene is a non-frothing oil" (Vol. IV, p. 1820, Q50), "non-frothing oils are always insoluble oils; kerosene, for instance" (p. 1816, Q24) "kerosene, by definition, by general acceptance is a non-frothing oil" (p. 1820, Q51). As to the other oils used by defendant he refers to defendant's mixture composed of (1) fuel oil, (2) kerosene, and (3) pine oil, and says that fuel oil is "a viscous non-frothing oil" and pine oil "is a frothing oil" (p. 1818, Q40).

These admissions, aside from other abundant evidence, establish the fact that the kerosene and fuel oil used by the defendant, although they have that preferential affinity for metalliferous mineral which characterizes all oils, do not, upon agitation and aeration, produce mineral-bearing air-froth, not having the bubble-making and bubble-modifying action, and therefore do not function as oils of the patent.

Defendant's counsel base their contention wholly upon the words "a preferential affinity for metalliferous matter" appearing in the opening paragraph of the patent specification as if referring to the word "oils" as well as the words "fatty acids, or other substances" (Spec., p. 1, lines 12, 13). Oils, without exception, have a preferential affinity for metalliferous matter. This was old and well known at the time of the invention. Had the patentees confined their invention to "oils" alone, the words having "a preferential affinity for metalliferous matter" would not have appeared—they would have been surplusage and unnecessary—and defendant's contention could not have been advanced. The quality of having "a preferential affinity for metalliferous matter" is not specified in the "oil" claims, claims 9, 10, 11 and 12. The word "oil" itself connotes this quality. The words "fatty acids and other substances" used in the opening paragraph of the specification, do not. *The patentees had to include in their specification a class of substances which were not oils,* for example, oleic acid (a fatty acid), and these substances, as they very properly said, had to resemble oils in having "a preferential affinity for metalliferous matter."

But that was not the only function that was essential. After their preferential affinity has been exercised in the agitated pulp and they have reached and efficiently attached themselves to the metalliferous matter in preference to the gangue, it remains for them to exercise upon it their further and characteristic bubble-making and bubble-modifying function. In Kirby and the other surface flotation processes of the prior art as described by this Court the oil used (kerosene oil, fuel

oil and other substances) went preferentially to the metalliferous matter and there exercised *by its buoyancy* a lifting force. In Cattermole as described by this Court, the oleic acid and other oily liquids used (including kerosene and fuel oils) went preferentially to the metalliferous matter and there exercised *by its quality of stickiness* an agglutinating action.

When the patentees made "the discovery embodied in the patent in suit" (242 U. S., 267), they were using oleic acid. *Oleic acid is not an oil* but a fatty acid. It has, however, the quality that all oils possess, i. e., a preferential affinity for metalliferous matter. In its action in the process it exercised two functions, (1) the old and well known function of all oils, a preferential affinity for metals, and (2), the newly discovered bubble-making and bubble-modifying function, the exercise of which was essential to the production of the new result of a mineral-carrying air-froth. If it had exercised only the first function and not the second also, the discovery would not have been made—the invention would not have been embodied.

Of the claims in issue, each and every one specifies *and requires* a special operation and result; claims 1, 2 and 3 "agitating the mixture *until the oil-coated mineral matter forms into a froth*"; claims 5, 6 and 7 "agitating the mixture until the oleic acid has been brought into efficient contact with the mineral *and has formed a froth therewith*"; claim 12 "agitating the mixture *to cause the oil-coated mineral to form a froth*"; claims 9, 10 and 11 "agitating the mixture *to form a froth*," limited by disclaimer to the same *mineral-carrying froth* as the other claims.

Thus the invention in its essential and characteristic features is clearly described in the claims, and obviously no oil or oily liquid that fails to function in the manner prescribed in the claims is the oil or oily liquid of the patent. Again, if an oil or oily liquid of the patent *is used and the results obtained* are those prescribed by the patent, then the addition of an oil or oily liquid which does not function as an oil or oily liquid of the patent, does not affect at all the fact that the process of the patent is being used.

The defendant and respondent, in its Brief opposing the Petition for Writ of Certiorari, states that the Circuit Court of Appeals "fully considered" the case, and

> "after studying the evidence, witnessing experiments, and making experiments itself, * * * found the fact to be that the petroleum constituent of defendant's mixture is *not* inert in the process; and that, therefore, it should be considered as the 'oil' of the claims in determining the question of infringement" (Brief for Respondent opposing Petition for Certiorari, pages 11 and 12; italics in original).

To begin with petitioners have no knowledge that the Judges of the Circuit Court of Appeals conducted experiments themselves, and are at a loss to understand how the defendant came by that information, and the further specific information that as a consequence of these experiments the Court "found the fact to be that the petroleum constituent of defendant's mixture is *not* inert in the process" and that "therefore, it should be considered as the 'oil' of the claims." The Judges of the Circuit Court of Appeals could not have found this fact on the evidence, because the evidence is overwhelmingly to the contrary. They could not have found this fact from illustrative experiments witnessed by them at the argument, because these illustrative experiments merely repeated the testimony. Therefore, if defendant's information is correct, the Judges of the Circuit Court of Appeals must have rested their judgment as to this fact upon experiments conducted by themselves of which petitioners have no knowledge. (See Supplemental Brief, pp. 127-140). "The petroleum oils used by defendant are not mineral-froth-forming oils with defendant's ore"). Any experiments that were performed for the benefit of that court by the parties were necessarily and by express ruling of the Court but repetitions of experiments performed at the trial in the District Court, where careful samples were taken of all the materials used in the experiments, which were all analyzed

or assayed by opposing parties. So also, in the District Court, at the trial, careful samples were taken of all results from the experiments, where the results were deemed by either party worthy of more than visual examination, and analyses and assays were made and were admitted in evidence in the sworn testimony. The question of fact should therefore only have been determined by the Circuit Court of Appeals from the sworn testimony brought to that Court by the appeal, and not from any tests made by the Circuit Court of Appeals itself or any tests carried out in that Court for illustration of the argument, without testimony as to recoveries, assays and samples.

The facts as to the petroleum constituents of defendant's mixture were found by the Trial Court. We may disregard laboratory experiments, which lose their importance when there is testimony of full-scale commercial operations. The defendant operated its plant in Butte for several months with these petroleum constituents added to pine oil. Judge Bourquin, in the opinion following the trial, sums up thus (Vol. I, p. 101):

> "From the evidence it appears the larger part of the oil used by defendant and all in excess of a fraction of 1 per cent. on the ore, if not inert is ineffective, wasted and injurious to the process and results. Before January 7, 1917, defendant used only pine oil and about 1.43 pounds per ton of ore, with excellent results. Since said date it uses a mixture of 20 to 24 pounds of oil per ton of ore, made up of 18 per cent. of pine oil, 12 per cent. of kerosene oil, and 70 per cent. of fuel oil, with poorer results. The kerosene and fuel oil are petroleums."

And states his conclusions as follows (p. 101):

> "Defendant uses the patent process, uses plaintiff's invention of ore concentration by air bubble flotation, uses the same elements in the same combination in the same way with the same function to the same, but poorer results; and exceeding the patent claims in reference to one ingredient (oil) uselessly, wastefully and injuriously and

merely with intent to avoid the letter of the patent does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process."

And generally as to the use of defendant's petroleum constituents Judge Bourquin says (p. 101):

"As before stated many oils are ineffective to operate the process and that is because they have not the quality that contributes to bubble-making. What this quality consists of, wherein it lies, does not appear. With these ineffective oils, agitation will not produce froth and so there is no flotation of the metallic particles. One of defendant's witnesses testifies that in the laboratory and plant of the Utah Copper, one thousand oils have been tried, of which but two mixtures give satisfaction. Petroleums seemed generally ineffective, by the evidence of both parties, though some of defendant's witnesses testify to sometimes successful experiments with them. Incidentally, there is suspicion that with experiments as with figures can be done anything for or against, without impropriety in the operator."

Defendant's counsel in their Brief in the Circuit Court of Appeals made the following statements (Appellant's Brief, p. 25):

"It will be seen, therefore, that according to plaintiff's own figures defendant has sacrificed *about a million dollars a year** in recoveries and added expenses in avoiding trespass upon the rights of the plaintiffs, as they have been defined by the Supreme Court; and that, therefore, the de-

*This "sacrifice" of about a million dollars a year still left the defendant a profit of more than $7,500,000 as directly due to the use of plaintiffs' flotation process (see defendant's sworn and filed reports on flotation operations for the year 1916, Plaintiffs' Exhibits 257-268, Vol. VI, pp. 2993-3015, showing a profit of $8,500,000 for that year). Further, had the defendant elected to use the process under license, as its neighbor the Elm Orlu Mining Company did, the royalty it would have been called upon to pay at the maximum rate of the Elm Orlu license agreement (Vol. VI, pp. 3060, 3061) would have been about $800,000 which is $700,000 less than the "sacrifice" deliberately selected as the alternative of the lawful use of the process.

fendant not only does not use the 'critical proportions' of oil to which plaintiffs' patent is limited, but it is not obtaining the results which could be obtained by the use of such 'critical proportions.'

"What the Supreme Court sustained the patent for is the difference between the results produced by the use of a fraction of 1% of oil and the results produced by the use of larger quantities of oil" (italics in original).

And again (p. 35):

"To respect the property rights of the plaintiffs as defined by the Supreme Court is, as we have shown (*supra*, p. 25) costing the defendant in reduced recoveries and increased costs over a million dollars a year."

In view of the facts, this argument of defendant's counsel amounts to this: we admit that we are using a substance, to wit: pine oil, which will effectuate the process of the patent in suit, and it is also the fact that it effectuates that process in a much better manner than where there is added thereto the other ingredients which we add, but by adding such other ingredients, namely, the petroleum oils used (which the evidence shows will not themselves effectuate the process) we get such a bad result that in that way we have avoided infringement. This argument need only be stated to carry its own refutation. It never can be held to be the law that a man can avoid infringement of a process by practicing it badly. The essential question for the court is not—is he carrying on this process well or ill, but is he carrying on the process? Petitioners insist that it is demonstrated that when defendant uses pine oil or any other oil of the patent in sufficient quantity to get the result, and adds thereto other oils or oily substances which will not effectuate the process nor prevent it, defendant is within the patent and cannot in that way avoid infringement.

Defendant, in denying petitioners' contentions as to the oil or oily material of the patent, presents this form of argument (Respondent's Brief in Opposition to Petition for Certiorari, pp. 12-14):

(1) The prior art patents fully justify our statements "that there is nothing novel in the use in quantities above one per cent. of various oils (including petroleum and its derivatives) and various mixtures of oils" (p. 12). This is in a sense true but their use was for a different purpose, and there was no recognition of the function of oil to modify air-bubbles so that mineral-air-froth resulted.

(2) "If the petitioners' present contention that petroleum or mineral oils are not the 'oil' of the claims were correct, they would have eliminated these prior patents which describe the use of petroleum by pointing out that fact" (p. 14).

(3) "Instead of doing that, they admitted, as the Court found, that these prior processes differed essentially from the process of the patent in suit not in the fact that the former failed to describe oils suitable for the purpose, but in the fact that they failed to describe the use of the critically minute quantities of these oils to which this Court limited the field justly covered by the patentees" (p. 14).

Petitioners entirely disagree as to (2) and (3).

In the Hyde case, the issues before this Court were, first, was the patent valid, and, second, had the defendant infringed by using the process with oleic acid as the only oily material. On neither issue did the question arise as to what oil *was* or *was not* suitable for effectuating the process.

No classification of oils can, so far as is known, be made in advance. The specification requires tests to determine which oils *will* and which oils *will not* effectuate the process upon given ores and under given conditions. It is the fact that so far kerosene and fuel oil and other equivalent oils (not necessarily including all petroleum derivatives such, for example, as gasolene or petrol, which defendant does not use), with defendant's ore and with every other ore with which they have been tested, will not work the process of the patent in suit and are not therefore mineral-froth-forming oils. No one has been able to use kerosene and fuel oil and other equivalent oils as mineral-froth-forming oils, although their cheapness has always

made them desirable. Petitioners' contention is *not* as stated by defendant's counsel. Petitioners' contention *is* that when any oil or oily substance will not effectuate the process of the patent in suit, it is not a mineral-froth-forming oil and is not therefore the oil prescribed by the patent and its use is immaterial in considering whether the patent is or is not being infringed.

In the Hyde case petitioners succeeded on both issues of validity and infringement, and it is difficult to conceive how, after the clear statements made by this Court, any one can misunderstand the true import of its decision.

The following brief extracts from the descriptions of the invention in the opinion of this Court will be sufficient to expose the error of the defendant's conclusions:

> "it produces a result never obtained before" (242 U. S., 268).
> "the resulting froth concentrates so different from the product of other processes" (p. 269).
> "it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate" (p. 266).
> "they are engaged upon a new method of separation" (p. 269).
> "the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles" (p. 269).
> "that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before" (pp. 268, 269).
> "a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment" (p. 265).

"This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used, and holding in mechanical suspension between 70 per cent. and 80 per cent. of the total mineral content of the mass treated" (p. 267).
"they discovered the final step which converted experiment into solution, 'turned failure into success' " (p. 271).
"a patentable discovery as new and original as it has proved useful and economical" (p. 269).

Defendant in its oral argument in the District Court made the following admission (Oral Arguments of Defendant, p. 34):

> "Now, I maintain that it has been satisfactorily proven by our witnesses, Professors Bancroft, Sadtler, Taggart and Beach, that there is no difference between the action of plus one per cent. of oil and minus one per cent. of oil in any respect that science can develop, and technically there is no difference. Our mill operations as set forth in these tabulated statements which we have introduced and in testimony of our witnesses show that there is no difference from a technical and commercial viewpoint. It is a case in which practice and theory are in absolute agreement."

Thus defendant admitted that there was no difference, scientifically or technically, between the action of the *less than one per cent.* of mineral-froth-forming oil that it had used before the decision of this Court in the Hyde case, and the action of a practically similar amount of mineral-froth-forming oil to which had been added larger amounts of non-froth-forming-oils, so as to make in the aggregate *more than one per cent.* of all oil, used after the decision of this court in the Hyde case. The facts went, however, beyond defendant's admission, because the effect of the addition of the non-froth-forming-oils was to impair the benefits of the results obtained so that commercially the defendant suffered the material loss stated by its counsel.

Then, in the Circuit Court of Appeals defendant-appellant there, made this further admission (Oral Arguments for Appellant, pp. 13, 14):

> "The defendant in this case, may it please the court, does not use more than one per cent. of oil because it cannot use less and get satisfactory results, or get even better results than it is getting now. It uses more than one per cent. of oil because the Supreme Court has said that it is not at liberty to use less than one-half of one per cent.; and like every burned child it dreads the fire and therefore is using more than one per cent. of oil.
>
> "Plaintiffs' counsel in this case have figured out from the testimony that the use by the defendant of more than one per cent. of oil has cost it, in increased cost and diminished recoveries, more than a million dollars a year. It is costing defendant more than a million dollars a year to avoid infringement of this patent, as it has been construed by the Supreme Court, according to the figures of plaintiffs' counsel. *What the Supreme Court gave the plaintiffs is the exclusive right to save that million dollars a year in a plant such as the defendant's.* Defendant is not saving that; it is not using the plaintiffs' process; it is not we submit, infringing the patent in suit."

With these two admissions, there is no escape from the conclusion that defendant's contention is that, although by the use of its mixture in excess of one per cent on the ore, it obtains the results of the patent in suit, these results are financially so much below what they would have been if defendant had not added, to the mineral-froth-forming oil, the non-froth-forming oil, that infringement is thereby avoided. This is based upon the argument that this Court validated the patent on the ground that by the use of the quantity of mineral-froth-forming oil within the terms of the claims, a *better financial result, not a different or new technical result,* was obtained, and so if to the mineral-froth-forming oil of the claims defendant adds non-froth-forming oil and gets *a worse financial result,* defendant is thereby avoiding the patent as validated by this Court.

The mere statement of this argument carries its refutation.

The facts and the law in the instant case are so comprehensively set forth in the opinion of the District Judge, that a consideration thereof with quotation and explanation and discussion, rather than an independent discussion in this brief of the facts and law, will most succinctly, and with judicial sanction, present the instant case. Reference is made, however, to the Supplemental Brief for Petitioners for further discussion and authorities.

The Findings and Opinion of the District Court.

The case was tried in open court before Judge George M. Bourquin, occupying five weeks. At the conclusion of the evidence Judge Bourquin, at the invitation of the defendant, inspected the operations at defendant's plant and, at the invitation of the plaintiffs, went from the defendant's plant to the neighboring Timber-Butte mill of the Elm Orlu Mining Company, a licensee of petitioners, and inspected the petitioners' process there proceeding.

The Findings.

The District Court found the issue of validity and both the issues of infringement in favor of petitioners (plaintiffs) and against the defendant—validity as to all claims in issue, including claims 9, 10 and 11 as limited by disclaimer; infringement as to all of these claims prior to January 7, 1917; and infringement since January 7, 1917, as to claims 1, 2, 3 and 12, and claims 9, 10 and 11 as limited by disclaimer (omitting the oleic acid claims 5, 6 and 7, not infringed since 1914); and directed an injunction and accounting in accordance with the prayer of the bill, and so decreed (Vol. I, p. 102).

THE OPINION.

The opinion (Vol. I, pp. 93-102) states the issues as novelty, invention, infringement, alleged delay and defects in disclaimer, and estoppel by replies of plaintiffs' counsel to inquiries of Justices of this Court at the argument of the Hyde case.

Novelty and Invention. The District Court calls attention to the fact that the issues of novelty and invention were decided by this Court in plaintiffs' favor in the Hyde case (242 U. S., 261) and postulates the fundamental principle touching the consideration of new evidence in the case at bar as follows (p. 99):

> "If it be conceded that new evidence might warrant and demand that a trial court hold invalid a patent by the Supreme Court held valid, such evidence must be unequivocal, clear and convincing, in quality and quantity that inspires confidence and produces conviction that the patent is invalid and that the Supreme Court would so determine beyond a reasonable doubt."

Of the new evidence in the case at bar the District Court says (p. 96):

> "The great mass of new evidence herein is but cumulative of the Hyde suit. The only new publication is the California Journal of Technology, detailing a suggestive but rather misleading and abandoned experiment sufficiently referred to and disposed of in the Miami suit." *

**This defense was not mentioned by the defendant in brief or argument in the Circuit Court of Appeals in the instant case.* In the Miami suit the same patent was involved as here and two later patents and the same prior art was set up by the defendant including the California Journal of Technology, which first appeared in that suit. In the District Court there (237 Fed., 609) the California Journal of Technology is discussed on page 623. It was there held that this article, while suggestive, did not negative invention in the patent in suit, that the experiments were mere laboratory tests and did not disclose the inventive idea and in fact led away from it. On appeal in that case (244 Fed., 752) the California Journal of Technology is referred to on page 755. After considering the entire prior art, including the California Journal of Technology, the Circuit Court of Appeals for the Third Circuit announces its conclusion, page 756, that the patent here in suit was not anticipated and involved a patentable invention of a high order of merit.

Summing up as to the new evidence the District Court says (p. 99):

> "Not only does it fail here [i. e., to inspire confidence and produce conviction that the patent is invalid and that this court would so determine beyond a reasonable doubt], but it *strengthens the conviction that the patent is valid.*"

In reaching this conclusion as to the effect of the new evidence in the instant case upon the issues of novelty and invention, the District Court first refers to the more recent history of the invention and then discusses the nature of the invention.

As to the more recent history, the District Court points out that the evidence in the present suit (p. 94)

> "discloses that though the use of the process is very wide, extensive and growing, its simplicity, economy and success still surprise and gratify the metallurgical world."

As to its nature, the District Court points out that the evidence in the instant case discloses the fact that (p. 94)

> "its laws or principles of operation still interest and puzzle the scientist."

and quotes defendant's witness, Professor Bancroft, of Cornell:

> " 'In the beginning it was very little knowledge and mostly guesswork and since then there has been every year a little more knowledge and still a great deal of guesswork.' "*

And the District Court thus comments on this (p. 94):

> "Though speaking for himself alone, the learned doctor's estimate might well be applied to all, practical layman and expert scientist alike."

Nevertheless, the District Court sets out conclusions warranted by present knowledge (p. 94):

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*See Vol. IV, page 1812, Q6.

"At the same time, though heretofore somewhat ambiguous and obscure, present knowledge warrants the conclusions that the gist of this remarkable and valuable process and the actual discovery and invention are that whereas theretofore in ore concentration air had been used in desultory and fugitive bubbles as a make-shift incident of and supplemental to oil and skin flotation, *air can be made to do all the work by creating in water-ore pulp modified by a suitable oily contaminant, an infinitude of bubbles.*"

The District Court finds that the invention is novel, saying (p. 94):

"*It is the first of its kind* and the patent sufficiently discloses it and methods to those skilled in the art."

The District Court points out that ambiguity and obscurity have been as much due to the extreme mechanical simplicity of the process as to its novelty, and, in an explanation of its laws and principles, the Court says (p. 94):

"The tendency was to attach prime importance to reduction in amount of oil used, when in fact this is but a necessary incident (for which there are substitutes if not equivalents) to the creation of the infinitude of bubbles that do the work."

And, continuing—

"Despite this tendency and to overlook the simple and obvious the patent fairly clearly sets out the various ways and means to create this infinitude of bubbles and that they do the work.

"The tests to determine which kind and amount of 'oily substance yields the proportion of froth or scum desired,' that flotation is 'mainly from the inclusion of air bubbles,' the froth, the agitation, are all so many guides in the patent, pointing the skilled operator to and including the infinitude of bubbles and the degree of agitation and amount of soap [decomposed into oleic acid] or oil to

> produce such bubbles, as surely as the word 'crystallization' points to appropriate temperature in Commercial Co. vs. [Fairbank Canning] Co., 135 U. S., 189, and the words 'uttered sound' by the 'human voice' to articulate speech in the Telephone Cases, 126 U. S., 531."

The District Court then considers that part of the new evidence consisting of "learned dissertations upon the philosophy of the process—upon *the philosophy of bubbles, the heart of it,* by Professors Bancroft of Cornell, and Taggart and Beach of Yale, and Drs. Sadtler of Philadelphia and Grosvenor of New York" (pp. 94, 95). The Court notes that the *bubble-making quality of oil is of the first importance in the process,* saying (p. 95):

> "This quality of oil is of first importance in the process. Another of lesser importance and which all oils possess is the 'preferential affinity for metalliferous matter over gangue.' Of lesser importance, because it is now known (and patented) that given another contaminant than oil but which possesses the like bubble-making quality though not the said 'preferential affinity' the process is equally successfully worked." *

The District Court proceeds (p. 96):

> "Air also possesses this 'preferential affinity' and in view of the foregoing it well may be that the capture as well as the flotation of the metallic particles is more due to the great volume of air than to the infinitesimal oil. That in this process air without oil cannot capture and retain the metallic particles, seems due to its inability to create bubbles without oil. And why this capture in any case, is still of the unsolved phenomena of the process."

The District Court points out that there are *"critical proportions"* of any oil used, but that this is *not a sharp divide but*

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*The reference here and the prior reference to substitutes for oil, are to the later discoveries of petitioners' inventors that certain soluble substances when completely dissolved in the water of the pulp, have the same froth-forming quality essential to flotation. See Patent No. 962,678 at issue and described in the Miami case (237 Fed., 609, and 244 Fed., 752), and in evidence here as Defendant's Exhibit 218, Vol. VI, p. 2920, original paging 5274. See also *supra*, pp. 11, 12.

rather a broad one, depending upon many circumstances mentioned and the Court adds (p. 96):

> "With excess oil, but not enough to defeat bubbles altogether, though of fair aspect to the eye the bubbles will not do the work. In the excess oil in the films the metallic particles do not cling but swim or slide to the bubble's lower surface, 'neck off'—detach and sink. The untechnical workman recognizes there are 'critical proportions' of oil, and small deviation from the pre-determined amount in the feed, whether more or less, manifests itself to him in the appearance of the froth and poorer results; and he knows and remedies the error in oil."

The District Court finds (p. 96):

> "Metallic content of ore seems of little importance—sometimes seems to require oil inversely."

An example is given from the operations at the Timber-Butte mill of the Elm Orlu ore, stated to be "from the same vein as defendant's," and from that example another conclusion is drawn as follows (p. 96):

> "it is the air and not at all the oil that floats the mineral, noting that in the first of this example 211 pounds of zinc are floated by air bubbles in the creation of which only .7 pounds of oil is used."

Three hundred pounds of zinc floated by the use of one pound of oil! Manifestly, as this Court found in the Hyde case, this is not oil-lift through the pulp or oil-flotation on the surface of the pulp, but air-lift and air-froth flotation.*

The District Court then observes that the manner of introduction of the air particles and the method of agitation may

*A simple calculation based on the lifting force of oil in water will show that for every 214 ounces of metallic zinc lifted in defendant's latest procedure (wherein a total of more than one per cent. of oil mixture is used), all of the oil mixture used if assumed to be wholly attached to the mineral particles (which it is not) would only have lifting force enough to lift less than one ounce of metallic zinc. So the results obtained in defendant's latest procedure cannot be accounted for on the theory of an oil-lift mode of operation.

be varied, provided "the oil-coated mineral matter forms into a froth," and as to agitation says (p. 96):

> "And it is all one whether this be applied agitation or self-agitation—the agitation set up by the air particles themselves in merely rising through the mass and thereby coming in contact with both water and oil, all co-acting to form bubbles which capture the metal."

Applied agitation is such agitation as occurs in the Gabbett mixer described in the patent in suit or in the mechanical agitators of plaintiffs and defendant in the Hyde case. Self-agitation occurs when air bubbles agitate the pulp by their movement through it. There is an example of self-agitation in the specification of the patent in suit, where it describes the liberation from solution of air introduced under pressure into the pulp, upon release of which the bubbles of air rise to the surface carrying metalliferous mineral and form an air-mineral-froth (Supplemental Brief, pp. 33-38). Another example is what are known as pneumatic cells, which the defendant here uses and which the defendant in the Miami suit used (244 Fed., 762-770).

The District Court also adverted to this subject when, in referring to the scientific evidence as to the philosophy of bubbles, the "heart" of the process, it said (p. 95):

> "that the mere introduction of particles of air into a liquid does not create bubbles, but that they are created by subsequent agitation, either applied or self-agitation."

The District Court here refers to the ultimate bubbles, the persisting mineral-coated bubbles of the floating froth. Submerged bubbles are produced by introduction of air into a pulp, but to function in the process they must be small bubbles and must be given opportunity to meet and attach to themselves the mineral particles. The mere introduction of air into a pulp and the mere introduction of a mineral-froth-forming oily substance into a pulp, do not create mineral-air-froth, but

both must in some manner be divided and disseminated so that the mineral is oil-coated and the "oil-coated mineral matter forms into a froth" (p. 96).

The directions of the patent for agitation may be analyzed as follows:

(1) Agitate to disseminate the oily liquid through the pulp and bring it into efficient contact with all the metalliferous mineral particles;

(2) Agitate to introduce the air;

(3) Agitate so that the "oil-coated mineral" combines with air-bubbles to form a froth of "oil-coated mineral matter."

Under (1) it is to be noted that when the mineral-froth-forming substance is viscous and its dissemination difficult, as is true of oleic acid (the only oily liquid specifically named in the patent and used by the defendant Hyde), the agitation required is much greater in degree or duration or both, than when the mineral-froth-forming oil is pine oil (pine oil being an essential oil of low viscosity, more easily disseminated and requiring less agitation) as in defendant's present procedure and in that of the defendant in the Miami suit. It should also be noted that, where the oiling of the mineral is effected by chemically precipitating the oleic acid previously diffused as a soluble soap throughout the pulp, as disclosed in the specification of the patent in suit (see Supplemental Brief, pp. 38-40), the necessity for agitation under (1) practically disappears.

Under (2) it is to be noted that when air is directly introduced, as by the liberation of air bubbles in the ore pulp, as disclosed in the specification of the patent in suit (see Supplemental Brief (pp. 33-38), or by forcing air into the ore pulp, as in the pneumatic cells now being used by the defendant here and also used by the defendant in the Miami suit, all necessity for agitation under (2) is eliminated.

With agitation for purposes (1) and (2) diminished or eliminated, it follows that little, if any, other agitation than agitation (3) is necessary, and the total agitation required is very greatly diminished.

The claims do not limit in any way the type of agitation and the specification discloses both "applied agitation" and "self-agitation of the patent. That is the only agitation prescribed or required by the claims.

Briefly it may be said that in each instance, any agitation that will under the conditions present and with the appliances used, form the froth of "oil-coated mineral matter," is the agitation of the patent. That alone is the agitation required by the claims.

This Court said in its opinion, quoting from Lord Shaw, that in the process here in suit reliance is had (242 U. S., 269)

> "upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells," etc.

Here the three elements of agitation are stated, viz: (1) oiling the mineral, (2) introducing air to form submerged bubbles in the ore pulp, (3) producing floating froth.

This Court also said (242 U. S., 270):

> "the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the *extent of agitation* necessary in order to obtain the best results."

This Court was then approving the statement of the specification that (Vol. II, p. 565; spec. p. 1, lines 63-67)

> "with different ores and with different oily substances * * * a simple preliminary test is necessary," etc.

The District Court, in dealing with the subject of the amount of oil, gives an extreme example, as follows (Vol. I, p. 95):

> "For the amount of oil to produce sufficient and efficient bubbles must depend on many other factors, viz.: the working cell space, amount of water, *degree of agitation*,

kind and amount of ore and perhaps on occasion amount of metallic content, kind of oil, etc. For example, if a ton of ore be agitated in a lake of water, doubtless a lake of oil will be necessary to create sufficient bubbles to capture the metal in the ore."

The District Court concludes its consideration of the philosphy of the process as follows (p. 96):

"The mineral particles, either oiled before or by contact with bubbles, attach to and enter the viscous films of the bubbles. The particles also increase the viscosity of the bubble films, armor them and increase their stability, perhaps as stays that decreasing the area of unsupported surfaces, increase the latter's ability to resist rupture."

The District Court briefly dismissed the California Journal of Technology, adopting the reasoning of the opinions in the Miami suit on that subject (*supra*, p. 32). In considering the new evidence the District Court said (pp. 96, 97):

"that progress in the process and methods of operating it, now discloses that with some ores and some oils or mixtures of oils, *the process can be fairly successfully operated with one per cent. and more of oil.*"

In this connection, the District Court found it proven "practically without conflict" (p. 97):

"that in all the operations with this process not to exceed .2 per cent. of oil is used, save by defendant and others in like situation and only since the decision in the Hyde suit and solely to avoid infringement; *that some oils are effective and more are ineffective to operate the process; and that the excess oil used is useless, wasted and harmful.*"

It then considered in detail the defendant's contention (p. 97):

"that this evidence demonstrates the process lacks novelty and invention, and that because of it the record is sub-

stantially different from the Hyde suit, the decision there should not control here, and the patent is and ought to be held invalid."

It found this contention (p. 97):

"Without support in the patent and Hyde decision."

As to the patent, the District Court analyzes the specification and claims (p. 97) and points out that the specification speaks only of the proportion of oily substance being "considerably reduced" as compared with the proportions previously employed in the Cattermole process—

"Considerably reduced,—say to a fraction of one per cent. on the ore,"

and says that the proportion varies with different ores and different oils,

"and so it is necessary to test 'to determine which oily substance yields the proportion of froth or scum desired,' "

and refers to the description in the specification of an example of a *particular ore* (Broken Hill ore) and a *particular oily substance* (oleic acid) wherein the proportion of oil required is "say from" one-fiftieth of one per cent. (0.02%) up to one-half of one per cent. (0.5%) on the weight of the ore.

As to the argument of the defendant that the words "having a preferential affinity for metalliferous matter" describe the only essential and identifying quality of oils for inclusion in the process, notwithstanding the fact that they were only used to qualify "fatty acids and other substances" in the specification and to qualify "oily liquids" in claims 1, 2 and 3, and would have been surplusage to qualify "oils," the District Court points out (page 95) that the quality of oily substances "to create bubbles" by the "meeting and coaction of water, oil and air" "is of first importance in the process," and that another

quality "of lesser importance and which all oils possess is the 'preferential affinity for metalliferous matter over gangue.'" Here the District Court but interprets the specification, giving full significance to the new disclosure of mineral-froth formation.

The District Court had earlier said as above quoted and here repeated (p. 94):

> "The tests to determine which kind and amount of 'oily substance yields the proportion of froth or scum desired,' that flotation is 'mainly from the inclusion of air bubbles,' the froth, the agitation, all are so many guides in the patent, pointing the skilled operator to and including the infinitude of bubbles and the degree of agitation and amount of soap [decomposed into oleic acid] or oil to produce such bubbles, as surely as the word 'crystallization' points to appropriate temperature in Commercial Co. vs. [Fairbank Canning] Co., 135 U. S., 189, and the words 'uttered sound' by the 'human voice' to articulate speech in the Telephone Cases, 126 U. S., 531."

As to the decision of this Court in the Hyde case, the District Court makes the following analysis (pp. 97, 98):

> "In upholding the patent the Supreme Court says that 'as described and practiced' the process consists 'in the use of an amount of oil which is "critical" and minute as compared with the amount used in prior processes' amounting to a fraction of 1 per cent. on the ore and 'in so impregnating with air the mass * * * by agitation * * * as to cause to rise to the surface * * * a froth * * * which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal'; that 'it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery'; that the facts are not over-stated by Liebmann that 'The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than

was ever heard of, and it produces a result never obtained before * * * ;' that the court is convinced that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before, and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical'; that the court agrees with the House of Lords decision; that the process is not one before described, but a new method in which flotation is by the 'buoyancy of air bubbles'; that tests to determine the necessary 'amount of oil and the extent of agitation,' and 'the range of treatment within the terms of the claims,' satisfy the law; but that while the patentees discovered the final step, precedent investigations were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of 1 per cent. on the ore' and therefore * * * the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12 * * * but * * * invalid as to claims 9, 10 and 11."

The District Court then states the following conclusion (p. 98):

"It seems clear neither patent nor decision undertakes to say the process depends upon less than 1 per cent. of oil or is inoperative with 1 per cent. or more of oil."

Summing up as to the notion that the invention resided in the use of a fraction of 1 per cent. of oil on the ore, the District Court says (pp. 98, 99):

"It is true that in the beginning and during the Hyde suit the patentees inclined to so believe or at least be-

> lieved better results would be obtained with a fraction of 1 per cent. of oil. Perhaps limited investigation and experience with few ores and oils justified the belief. Indeed, all experience to date, plaintiffs', defendant's, strangers', demonstrates that with any ore and any efficient oil, less than 1 per cent. of oil gives better results, all circumstances considered. The 'critical proportions' referred to seem absent, in terms from the patent, and ought not to be adversely inferred in disregard of construction in favor of the patentee where the patent is ambiguous. The patent describes oil 'considerably reduced,' and refers to a 'fraction of 1 per cent.' by way of example. And though some claims limit oil to such fraction, and a limited range within it, others are for 'a small quantity' and for that reason held invalid by the Supreme Court. With the later knowledge of this suit it is doubted that such would be the decision now."

It may be noted here that Judge Bourquin does not call attention to the fact that claims 9, 10 and 11 were also not limited to the production of a "froth of oil-coated mineral" or a mineral-carrying froth, as were all the claims held valid, but only to the production of "a froth." They were therefore not limited to the new results obtained by the invention. Evidently his doubt that this Court would have held claims 9, 10 and 11 invalid on the later knowledge of the present suit, arises from his belief that these claims were held invalid solely because of the breadth of the expression "a small quantity of oil." Whatever his belief or doubt, he strictly followed the opinion of this Court as he interpreted it.

The District Court then states the conclusion that the limitation or confinement of the patent imposed by this Court "indicates" (p. 99) that this Court "believed the process might be operative with 1 per cent. and more of oil, and contemplated that this would not defeat the patent but might affect infringement." Petitioners do not so interpret the decision of this Court and respectfully present their interpretation, viz., that this Court, although having no evidence before it that the process could be worked with one per cent. or more of any

oil, nevertheless, in confining the patent and thereby limiting its scope, did not confine it to *the use of* a fraction of one per cent. of oil but to a *process identifiable* by its results, wherein *the "results obtained"* were the new results first obtained by the process of the patent in suit. It seems clear to petitioners that this Court in confining the patent, as it did, both secured the benefits of the invention to the patentees and protected the rights of the public to the use of prior processes or of any subsequent process producing a different result wherein oil was or is used, whether the oil used is greater or less than a fraction of one per cent. This Court said (242 U. S., 271):

> "the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

Under this decision of this Court petitioners have ample protection of their invention if they obtain the substance and not the shadow. The instant case abundantly shows how easy it is for an infringer to avoid the patent and yet obtain the benefit of the invention if the patent is erroneously construed, and the decision of this Court misinterpreted. The infringer has merely to add to one per cent. of an ineffective oil a small fraction of an effective oil. In such case there is no reasonable doubt that the results he obtains are the "results obtained" by a small fraction of one per cent. of oil. Similarly an oil may be selected which is an ineffective oil in the process, but which is contaminated with an oil effective in the process. When such an oil is used the small fraction of one per cent. of effective oil is responsible for the results obtained. Analytical determination of the quantity present of such effective oil may be difficult, but the results obtained can be easily and infallibly identified as the new results first obtained by the process in suit. The decision of this Court in four instances describes the process as identifiable in this manner, viz., "it produces *a*

result never obtained before" (242 U. S., 268), *"the resulting froth concentrate* so different from the product of other processes" (p. 269), "it differs so essentially from all prior processes in its character, in its simplicity of operation and in *the resulting concentrate"* (p. 268), and finally "the patent must be confined to the *results obtained,"* etc. (p. 271), as above fully quoted.

Judge Bourquin's discussion of novelty and invention concludes with the statement above quoted that the new evidence in the instant case

> "strengthens the conviction that the patent is valid."

Disclaimer as discussed in the opinion of the District Court. —The subject of disclaimer is dealt with on page 99. The District Court holds that the disclaimer "was timely filed," noting that it was within the time limited for petitions for rehearing in this Court.

As to the substance of the disclaimer, the District Court holds that it fairly conforms to the language of the decision of this Court "although the parties differ as to its interpretation even as they do in respect to the decision." Under that decision, the District Court points out, claims 9, 10 and 11 included what the patentees were entitled to and more, and says (p. 99):

> "The decision pointed out the excess. The patentees disclaim the excess. They can safely rely upon the decision and a disclaimer conforming to the language of the decision is sufficient."

Infringement as discussed in the opinion of the District Court. On the issue of infringement the District Court deals first with the period prior to January 7, 1917, and then with the period subsequent to that date.

As to the period prior to January 7, 1917, the District Court points out that the defendant admits infringement before suit

brought and up to that date, and summarizes the testimony as to the enormous and profitable extent of that infringement, and from the figures, year by year, it finds (p. 100):

> "Progress is indicated by leaner ores, less oil, higher grade concentrates, greater recoveries, all coincident with advancing time."

The District Court then adds (p. 100):

> "It is noted that the process is responsible for advance in methods, devices and machines for its operation,"

and then briefly describes the process constituting the admitted infringement from a date prior to the filing of the original bill down to January 7, 1917 (p. 100).

As to infringement after January 7, 1917, the District Court points out that (p. 100)

> "the defendant's methods are as before, save pneumatic as well as mechanical agitation is employed in the lower four cells of the pyramid. Some spitzkasten are blocked, an additional cleaner operation is used, and from which for some unexplained reason 8.65 per cent. zinc tails go to waste, and oil in amount 1 per cent. and more on the ore is used."

This sending of a highly valuable product to waste, containing 8.65% zinc (173 pounds of zinc to the ton), astounding to a metallurgist, was found to exist when defendant's plant was exhibited to petitioners' representatives during the trial. It was an incident of plant manipulation in dealing with excessive amounts of ineffective oils.

Considering this question of infringement (the only contested question of infringement in the case) the District Court points out, first, the practical effect of the use of the excess oil. He says (p. 100):

> "Defendant not very insistently claims results for this latter period are more profitable than for the former, but

> plaintiffs' analysis, neither denied nor criticized, and beyond both, of defendant's reports and tabulations makes manifest the fact is otherwise to the extent of about $1.75 per ton of ore—an enormous loss on 45,000 tons monthly."

a loss amounting to about $1,000,000 a year, as defendant conceded before the Circuit Court of Appeals.

And the District Court adds:

> "There is considerable like testimony in reference to operations by other infringers."

The other infringers are Utah Copper Company, Chino Copper Company, and Ray Consolidated Copper Company, associated with the defendant in the Jackling group of mines. Their engineers, the Janneys, Conrad, Wicks, Englemann and others, as witnesses for defendant, testified to successful and long continued operations in their entire flotation plants with minute amounts of oil before the decision of this Court, and of the change in the smaller portions of their flotation plants to oil-wasting operations like those of the defendant, promptly after that decision.

The losses from these operations of defendant and other infringers are largely due to diminished value of the products obtained and not to the increased cost of the oil, because of the cheapness of the ineffective oils.

The District Court says (p. 100):

> "Defendant practically admits that it now uses the present amount of oil merely to avoid the patent. It is done, says its counsel in argument, 'because the Supreme Court has said it is not at liberty to use less than one-half per cent.,' and 'out of abundance of caution' it uses 'more than 1 per cent.' The evidence likewise persuades."

The District Court then states its interpretation of the confinement of the patent imposed at the conclusion of the opinion

of this Court as confining the patent to the "use" of a fraction of one per cent. of oil rather than to a process identified by "the results obtained" by the use of oil in such a fraction. It criticizes the arguments made by petitioners as to the intent and meaning of the words "results obtained" in the opinion, of this Court, which petitioners contended were intentionally used for identification of the process to which the patent was confined. The District Court, however, interprets the word "use," to which it attaches principal significance, in strict accordance with patent law, and says (p. 101):

> "It is believed, however, that the court employed the word 'use' in its, or the ordinary sense of *beneficial* service."

beneficial service meaning that service or function which achieves the mineral-froth flotation.

The District Court then lays down the proposition (p. 101):

> "Patent law is not concerned with the useless, and a vaulable result sought is not 'obtained' by but *despite* the use of an excess of an essential ingredient, which excess renders no or ill-service."

Turning to the evidence, the District Court says (p. 101):

> *"From the evidence it appears the larger part of the oil used by defendant and all in excess of a fraction of 1 per cent. on the ore, if not inert is ineffective, wasted and injurious to the process and results.* Before January 7, 1917, defendant used only pine oil and about 1.43 pounds per ton of ore, with excellent results. Since said date it uses a mixture of 20 to 24 pounds of oil per ton of ore, made up of 18 per cent. of pine oil, 12 per cent. of kerosene oil, and 70 per cent. of fuel oil, with poorer results. The kerosene and fuel oil are petroleums."

Reviewing the evidence as to these petroleums and their effect in the process, the District Court says (p. 101):

"As before stated (page 95) many oils are ineffective to operate the process and that is because they have not the quality that contributes to bubble-making. What this quality consists of, wherein it lies, does not appear. *With these ineffective oils, agitation will not produce froth and so there is no flotation of the metallic particles.* One of defendant's witnesses testifies that in the laboratory and plant of the Utah Copper, one thousand oils have been tried, of which but two mixtures give satisfaction. Petroleums seemed generally ineffective, by the evidence of both parties, though some of defendant's witnesses testify to sometimes successful experiments with them. *Incidentally, there is suspicion that with experiments as with figures, can be done anything for or against, without impropriety in the operator.*"

The District Court then states from the evidence, and thereby emphasizes the fact, that (p. 101)

Some petroleums are used in limited quantities but always in combination with a recognized bubble-making oil, and only, it is said, for a somewhat bubble stabilizing effect."

This is a reference to the use of such petroleums as defendant employs, in minute amounts and in connection with a soluble frothing agent, and which, thus used, perform the function of preventing coarser metallic particles from falling out of the froth, thereby saving expense in grinding (Higgins, Vol. V, p. 2612, Q42).

The District Court then reasons as follows (p. 101):

"Defendant's present mixture of oil contains more pine oil on the ore than it used alone before January 7, 1917. The other factors the same, it is obvious the excess petroleums in the mixtures are responsible for the poorer results."

The conclusion of fact is then stated that (p. 101)—

"Defendant uses the patent process, uses plaintiff's invention of ore concentration by air bubble flotation, uses

the same elements in the same combination in the same way with the same function to the same, but poorer, results";

and the conclusions of law (p. 101):

"and exceeding the patent claims in reference to one ingredient (oil) *uselessly, wastefully and injuriously and merely with intent to avoid the letter of the patent* does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process. The excess oil either exercises no function or less efficiently exercises the same function in the same way as the limited oil and to the same but poorer results."

And the District Court continues with the more general proposition of law (pp. 101, 102):

"To secure to patentees their invention, the law looks quite through mere devices and forms, to the substance of things. And if in substance the invention is taken, if the thing that does the work is taken, all devices to evade the letter of the patent avail nothing to escape the consequences of infringement. Neither principle nor authority to the contrary, is cited or known to the court." *

Estoppel as Discussed in the Opinion of the District Court. The pleaded defense of estoppel by arguments in this Court as affecting infringement (Answer, Vol. I, p. 86, last paragraph) is quickly disposed of, the District Court merely saying (p. 102):

"In the matter of estoppel affecting infringement, it suffices to say neither in pleading nor proof do the elements of estoppel appear."

This finding was accepted by the Circuit Court of Appeals. The colloquy with Justices of this Court at the argu-

*For discussion of the law on infringement, see Supplemental Brief, pp. 112-123, and for a brief discussion herein see *infra*, pp. 85-90.

ment, appearing in the privately printed oral arguments, and therefrom put in evidence and pleaded as an estoppel, was not referred to by the Circuit Court of Appeals as creating an estoppel, but as indicating "the scope and accurate meaning of the expressed thought of the Court" (Judge Hunt's opinon, Vol. VI, p. 3108, Appendix to Petition, p. 35), and as aiding the Circuit Court of Appeals to "a better understanding of the statement of the limitation of the claims of the patent and of the definition of the invention included in" the "language" of the decision of this Court (*idem*).

Errors of the Circuit Court of Appeals.

Fundamental error. The fundamental error of the Circuit Court of Appeals consisted in reverting to and relying upon its former decision in the Hyde case (214 Fed., 100) as to the facts of the prior art and the relation of the invention in issue to that art, *notwithstanding the contrary findings of fact and conclusions of this Court and the consequent reversal of that decision.* Ostensibly Judges Ross and Hunt in their opinions followed the decision of this Court in the Hyde case. Actually they followed the prior decision of their own court as to the fundamental basis of the patentability of the invention in suit, interpreting the decision of this Court as consistent with the prior decision of their own court in these particulars, and as differing only in the conclusion of law that the difference merely in degree in this case is patentable. They clearly express the conviction that the invention in issue, although, as their court had found it to be in the Hyde case, *a mere difference of degree,* was to be deemed a patentable invention because this Court had so held. As Judge Hunt said it was held patentable because "certain remarkable and great results come from the use of the critical proportion" (Vol VI, p. 3108; Appendix to Petition, p. 37). He did not describe it, as the opinion of this Court describes it, as "a patentable discovery as new and original as it has proved useful and economical" (242 U. S., 269) "a new method of separation" (*ib.*), produc-

ing "a result never obtained before" (p. 268). Judge Hunt omits novelty altogether, describes the results merely as "remarkable and great," and characterizes the process as one wherein "the *maximum* froth" is obtained by the "critical proportion of oil" (Vol. VI, p. 3108; Appendix to Petition p. 37).

Judge Hunt must have taken his facts of the prior art from the prior decision of his own court. Indeed the statements above quoted are founded upon the erroneous conception of the operation of the process disclosed in the Cattermole patent which appears in the prior decision of his court and which is directly contradicted by the opinion of this Court in the Hyde case. His full statement as to this point is as follows (Vol. VI, p. 3108; Appendix to Petition p. 37):

> "*In the Cattermole process the froth was held to be distinguishable* from the froth produced in the patented process of the critical proportion of oil by the fact that certain remarkable and great results come from the use of the critical proportion which were not obtained when the quantity used in the Cattermole process was employed.
>
> "By using the critical proportion of oil as defined, patentees get the *maximum* froth."

Thus he describes the Cattermole process as one which produces the mineral-air-froth—the same froth as the process in suit except that it contains more oil—as it was described in the prior decision of his court. He overlooked the fact that in the decision of this Court it was properly described as a "metal-sinking process" which "reverses the action of the surface flotation process" (242 U. S., p. 265). He does not say the patentees obtained a new result, as this Court did, but says, as his court said in the Hyde case, that the patentees obtained an old result, an old froth, conceding that it was obtained at its maximum—"the maximum froth."

Judge Ross avowedly took his facts as to the prior art from this prior decision of his own court, citing it as his authority and saying (Vol. VI, p. 3103; Appendix to Petition, p. 25):

"It is not denied that at the time of the invention in question the affinity of oil for the metalliferous portion of powdered ore, when mixed with water, was well known, as well as the further fact that the agitation of such a mixture with, as well as without, the addition of acid, would carry the metalliferous portions to the surface of the mixture and the gangue to the bottom; *certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this court* when this patent was last under consideration here and when the whole patent was by this court held void as lacking invention (214 Fed., 100)."

The above quotation indicates that Judge Ross made no distinction in kind between the oil-floats of the prior art and the air-froth of the patent in suit. He but reiterates in substance what was said in the reversed decision of the Circuit Court of Appeals in the Hyde case. There his court said as to the claims of the patentees (214 Fed., 109):

"What they claim to be the new and useful feature of their invention, as stated by their counsel, is *'agitating the mixture to cause the oily-coated mineral to form a froth.'* As we have seen, *that feature was clearly anticipated by the prior art,* and, when the elements of the appellees' claims are read one by one, it will be found that each step in their process is fully described in more than one of the patents of the prior art, *with the single exception of the reduced quantity of oil which they use.* The patentees of the appellees' patent made a valuable contribution to the art in discovering *the smallest quantity of oil which would produce the desired result.* * * * Their discovery that a small fraction of 1 per cent. of oil is sufficient to produce flotation of the metalliferous matter cannot, as we have seen, be made by itself or in a combination the subject of a patent. The appellees cannot take from others the right to use oil economically."

And again (p. 105):

"To discover that the desired result may be accomplished with the use of a fraction of 1 per cent. of oil when for-

> merly a much larger quantity of oil had been used, and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. *It is a difference of degree and not of kind.*"

And again (p. 104):

> "When the claims and the description of the process of the appellees' patent are compared with the patents of the prior art, it will be seen that *the only material difference is in the smaller quantity of oil which the appellees use.*"

After consideration of the entire prior art as proved and of the process of the patent in suit, the Circuit Court of Appeals in the Hyde case said, as to practically all of these processes except the Elmore bulk-oil-buoyancy flotation process—as to Haynes, Everson, Schwarz, Froment, Kirby, Cattermole and the process of the patent in suit (214 Fed., 106, 107):

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this court, convince us *that the froth in all these processes is the same, with the exception that there is less oil* (as there must necessarily be) in the appellees' froth than in the others. The froths are all similar in appearance; they all rise to the surface after the same amount of agitation; they all gather with equal efficiency the same quantity of metal; and all may be removed from the surface in the same way."

This Court, in reversing that decision, pointed out that the prior art disclosed processes (242 U. S., 264),

> "all of which, speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass —'the pulp'—thus formed so as to separate *the oil,* when *it* became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue."

This Court thus described *all of these prior art processes* as processes wherein *oil* became impregnated or loaded with metal and metal-bearing particles, and wherein the *oil,* thus impregnated or loaded, was separated from the gangue. No comprehension of that fundamental fact appears in the opinions of Judges Ross and Hunt in the instant case.

This Court then divided these processes into two classes and said of the process of the first class, or "surface flotation process" (pp. 264, 265):

> "it depends for its usefulness on *the oil used being sufficient* to collect and hold in mechanical suspension the small particles of metal and metaliferous compounds, and *by its buoyancy* to carry them to the surface of the mixture of ore, water, and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrates thus obtained into any desired receptacle."

Thus this Court described the prior art surface flotation process as *essentially an oil-buoyancy process producing an oil-float.*

In describing the process in suit and differentiating it from the prior art this Court said (242 U. S., 268, 269):

> "It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the *lifting force* which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the bouyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the *buoyancy of the air bubbles* introduced into the mixture by an agitation greater than and different from that which had been resorted to before, and that this advance on the prior art and *the resulting froth concentrate so different from the product of other processes* make of it *a patentable discovery as new and original as it has proved useful and economical.*"

And this Court stated its agreement with the House of Lords and quoted from Lord Shaw that the patentees (p. 269)

> "are engaged upon *a new method of separation.*"

And this Court adopted the statement of the witness Liebmann that the process (p. 268)

> "produces a result never obtained before."

This Court clearly differentiated the "metal-sinking process," typified by the Cattermole patent, as in a wholly different class from the "surface flotation process" described by it in the above quotations in the references therein to the prior art. In its opening classification of the patents of the prior art, following the description of the surface flotation process, this Court said (p. 265):

> "The process of the other class, called in the record the *'metal-sinking process'* reverses the action of the surface flotation process and is illustrated by the Cattermole U. S. patent No. 777,273, in which oil is used to the extent of 4 per cent. to 6 per cent. to 10 per cent. of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of *agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink* to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water."

This Cattermole process, so clearly described by this Court as a metal-sinking process, was by the Circuit Court of Appeals, in its decision in the Hyde case, described as a process wherein (214 Fed., 106) "a froth necessarily came to the surface" in what it erroneously conceived to be a distinct first step of the process, producing a mineral-froth. It said (page 104):

> "there is first a violent agitation to cause the oil to gather up the metalliferous particles, as in the case of other oil flotation processes."

It also included the Cattermole process in the general statement, above quoted, wherein it said (214 Fed., 106, 107):

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this court, convince us *that the froth in all these processes is the same, with the exception that there is less oil* (as there must necessarily be) in the appellees' froth than in the others. The froths are all similar in appearance; they all rise to the surface after the same amount of agitation; they all gather with equal efficiency the same quantity of metal; and all may be removed from the surface in the same way."

This erroneous interpretation of the Cattermole patent by the Circuit Court of Appeals in the Hyde case is again adopted by Judge Hunt, as shown above (*supra*, p. 53).

Defendant, in its brief and oral argument before the Circuit Court of Appeals in the instant case, argued that (Appellant's Brief, p. 25):

> "What the Supreme Court sustained the patent for is the difference between the results produced by the use of a fraction of 1% of oil and the results produced by the use of larger quantities of oil."

And again (p. 35):

> "To respect the property rights of the plaintiff as defined by the Supreme Court is, as we have shown (*supra*, p. 25), costing the defendant in reduced recoveries and increased costs over a million dollars a year."

And in the oral argument (Oral Arguments for Appellant, p. 14):

> "What the Supreme Court gave the plaintiffs is the exclusive right to save that million dollars a year in a plant such as defendant's."

Judge Ross, however, does not so view it. In his opinion, the only saving which the invention in suit effected was in the

cost of oil by reason of the smaller amount of oil used. It is apparent from an interpellation which Judge Ross makes when quoting from the opinion of this Court, that in his judgment this Court only gave the plaintiffs the exclusive right to carry on an old process with a smaller quantity of oil with no advantage except the saving in the cost of the oil.

This quotation, with its interpellation, as it appears in Judge Ross' opinion, is as follows (Vol. VI, p. 3103, Appendix to Petition, p. 26):

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (the former patents having used *so much oil* as to make *its* cost prohibitive—our observation)," etc.

This observation of Judge Ross, that the difference between the prohibitive cost of oil of all of the processes of the prior patents and the smaller cost of oil of the process in suit, was the final step which converted experiment into solution, turned failure into success, is intended by him to be a summation of all of the advantages of the invention. It excludes from the "step" which constituted the invention everything else except the saving in the cost of oil. It is certainly not warranted by the opinion of this Court. The only instance there of a reference to prohibitive cost of oil is as to one prior invention, Kirby's, which is, however, elsewhere differentiated in all the other and more important particulars. This observation of Judge Ross could not be founded upon the facts proved in the instant case. Even defendant's contention conceded much more than mere saving in oil, as we have shown. This observation, therefore, can only be founded on the prior opinion of Judge Ross' court in the Hyde case, and with that opinion it is wholly consistent.

This view of Judge Ross that the invention in issue effected merely a saving in the cost of oil in an old process appears again later in his opinion. He gives a long quotation from

the opinion of this Court (Vol. VI, pp. 3104, 3105; Appendix to Petition, pp. 27-29) in part describing what took place at the birth of the invention, and in part adopting, as not an overstatement, the facts with respect to the invention, that "The present invention differs essentially from all previous results * * * it produces a result never obtained before. * * * The simplicity of the operation, as compared with the prior attempts, is startling," and concluding with the stated conclusion of this Court as to novelty that "the lifting force * * * is * * * chiefly, in the buoyancy of air bubbles * * * and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical."

Following this quotation, Judge Ross says (Vol. VI, p. 3105; Appendix to Petition, pp. 29, 30):

> "Nothing, it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court, than that it did not intend to extend the monopoly of the patent in suit to the use of one per cent. of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellees' 'experimenters' only rose to the dignity of *invention* when they ascertained that the desired results could be and were obtained by the use of five-tenths (½) of one per cent. of oil on the ore," etc. (Italics by Judge Ross.)

In other words, Judge Ross is of opinion that all that petitioners' "experimenters" did was to ascertain that *"the desired results"*—the old and known results—the old float—the old froth concentrates—could be obtained with this smaller amount of oil than it had been deemed possible to use before; and that this Court held that the work of these "experimenters" "rose to the dignity of *invention*" (italicized) when this ascertainment was made. This but reiterates the views of his own court in the Hyde case, as follows (214 Fed., 109):

> "The patentees of the appellees' patent made a valuable contribution to the art in *discovering* the *smallest quantity of oil* which would produce *the desired result.*"

Indeed the language of the earlier opinion is but paraphrased in the later opinion, which again admits that a "discovery" was made, and again asserts that this discovery was that "the desired result" could be obtained with less oil than formerly.

Judge Hunt in stating the grounds of his concurrence with Judge Ross (Vol. VI, p. 3107; Appendix to Petition, p. 32) evidently accepts the reasoning and conclusions of the opinion of Judge Ross, for without other basis than appears in that opinion he accepts the scope-defining expression in claims 1, 2 and 3, as to oily liquid quantity, "amounting to a fraction of one per cent. on the ore," and the similar expression in claim 12, "amounting to a fraction of one per cent. of oil on the ore, as describing *"this extremely small fraction of one per cent."* He refers to claims 5, 6 and 7, saying that they express "amounts percentages on the ore," but does not state what these amounts percentages are, or the fact that the claims are oleic acid claims. He summarizes, using the expression above quoted, as follows (Vol. VI, p. 3107; Appendix to Petition, p. 32):

> "The essence of the invention was in the use of *this extremely* small fraction of one per cent."

Then, as to the novelty of the invention, he says:

> "No monopoly could be given on the use of a small quantity of oil for that was old. *It was new, however, to avoid the use of larger quantities.*"

The larger quantities he refers to are quantities larger than "this extremerly small fraction of one per cent." which, in his view, was "the essence of the invention."

This is the only instance in which Judge Hunt refers to any novelty in the invention. It is the only novelty which his mind encompassed. It is the novelty found by the decision of his

court in the Hyde case, and he but again says what his court there said as to "the essence of the invention," that (214 Fed., 104):

> "the only material difference is in the smaller quantity of oil."

A reiteration of the error of the former decision of the Ninth Circuit Court of Appeals, that all the prior oil-using processes (except Elmore) produce the same kind of air-froths as the process in suit, appears in Judge Hunt's opinion. He says (Vol. VI, p. 3108; Appendix to Petition, p. 36):

> "But *the froth* developed in using the minute quantities of oil *is*, I think, *essentially of a character like* the froth shown when different quantities of oil are used—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this."

This may be compared with the following statement in the former decision of his court (214 Fed., 106):

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this court, convince us that the froth in all these processes is the same * * *."

The only substantial difference between these two statements is, that in the statement first quoted, of Judge Hunt in the instant case, the evidence is not referred to.

In court room experiments the practiced eye of the specially trained flotation expert alone can interpret what is observed so as to distinguish the real mineral-air-froth from a spurious froth. As Judge Bourquin said in the instant case (Vol. I, p. 96):

> "With excess oil, but not enough to defeat bubbles altogether, though of fair aspect to the eye the bubbles will

not do the work. In the excess oil in the films the metallic particles do not cling but swim or slide to the bubble's lower surface, 'neck off'—detach, and sink."

The analysis of the assayer, but not the eye of the unpracticed observer, detects the fact that the bubbles "though of fair aspect to the eye," do not "do the work."

In the mill, however, Judge Bourquin says (*ib.*):

> "The untechnical workman recognizes there are 'critical proportions' of oil, and small deviation from the predetermined amount in the feed, whether more or less, manifests itself to him in the appearance of the froth and poorer results; and he knows and remedies the error in oil."

Judge Bourquin also said (Vol. I, p. 101):

> "Incidentally, there is suspicion that with experiments as with figures, can be done anything for or against, without impropriety in the operator."

Judge Hunt was simply repeating the error made by his court in the Hyde case, and, exercising his independent judgment as to the visual appearance of the results of court room experiments (made by way of illustration of the argument on appeal), reached conclusions as to questions of fact in disregard of the establishment of these facts by the evidence, and in disregard of the large and controlling facts proved at the trial as to the history of the invention and the practical use of the process in suit in the art of ore-concentration. It is submitted that an appellate court should not decide questions of fact as Judge Hunt says he decided this question of fact.

Judge Hunt's statement above quoted is immediately followed by the statement wherein he imputes to this Court a finding that the "froth" of the "Cattermole process" was "held to be distinguishable from the froth produced in the patented process of the critical proportion of oil," etc. (Vol VI, p. 3108;

Appendix to Petition, p. 37), as considered above. This statement follows the stated conclusion of non-infringement. Its force and effect therefore is to accentuate the interpretation of the opinion of this Court in the Hyde case as confining the patent to the use of not more than one-half of one per cent of any and every oil, an interpretation which leads to artificial and arbitrary limitations and extensions of the patent without basis in operation or result, and without basis in reason. Its fundamental error is that it accepts the facts of the prior art as found in the prior decision of his own court and of the relation of the invention in issue to that prior art as thus found, and ignores the plain reversal of that decision in those particulars by this Court.

The opinions of Judges Ross and Hunt do not fix a lower limit on the critical proportions to which they say this Court confined the patent in suit, although the logical conclusion of their reasoning is that the lower limit for oleic acid suggested in the patent should be imposed. If it follows that because *oleic acid* has not been found to effectuate the process at a higher limit than one-half of one per cent. (0.5%) anyone may evade the patent by using more than one-half per cent. *of any oily liquid*, then it likewise follows that because *oleic acid* has not been found to effectuate the process at a lower limit than one-fiftieth of one per cent. (0.02%) anyone would be permitted to evade the patent by using less than one-fiftieth of one per cent. *of any oily liquid*. There is just as much ground for the second conclusion as for the first. Both are equally unsound. Judge Ross says there should be a lower limit, but does not definitely name it. Judge Hunt quotes the suggested lower limit of the patent for oleic acid but does not include it in his conclusions. *Dehors* the record, the defendant has, within the past few weeks, moved Judge Bourquin to amend the injunction by fixing a lower limit of one-fiftieth of one per cent., and may have devised a method of extracting the very essence of a mineral-froth-forming oily liquid, and, by using it in an amount below this minute quantity (at less than two-fifths of a pound to the ton of ore), may have effectuated the

process. The motion was denied, but it suggests another possible subterfuge—another loophole for the escape of an ingenious infringer.

Errors of Law. The principal errors of law of the Circuit Court of Appeals were in construing the patent in suit, and they may be summarized as follows:

1. The inclusion in the patent of *any* oil or oily liquid having a preferential affinity for metalliferous matter over gangue, *whether capable of effectuating the process or not.*

2. The limitation of all claims of the patent to the use of one-half of one per cent of oil or oily liquid.

First Error—Alien-oil inclusion. Ostensibly the opinions of the Circuit Court of Appeals are founded upon the opinion of this Court in the Hyde case (242 U. S., 261); in fact, however, the majority opinions re-echo the fallacies of the reversed opinion of that court in the Hyde case, as has been shown above.

As to the first error, we will first consider the opinion of Judge Hunt, who alone discusses it. Relative to oils capable of effectuating the process and oils not capable of effectuating the process, Judge Hunt, referring to the opinion of this Court, says:

> "Nor do I think there is ground for saying that discrimination was had between known oils—whether vegetable, mineral or animal" (Vol. VI, p. 3108; Appendix to Petition, p. 35).

For this reason, i. e., that this Court did not discriminate between oils of the patent and oils not of the patent (whereas this Court precisely pointed out and approved the method of discrimination described in the specification), Judge Hunt concludes (Vol. VI, p. 3108; Appendix to Petition, pp. 35, 36):

> "To oily liquids which have a 'preferential affinity to metalliferous matter' must the plaintiffs be held, and in using kerosene or fuel oil defendants are but employing oils which the patents authorize the use of; and when defend-

ants use proportions beyond the critical ones of oil, not oleic acid, but other oils, they are not infringing."

In other words, Judge Hunt is of opinion that this Court held that the only essential quality of the oily liquid used in the process is its selective affinity for metalliferous matter, regardless of whether it functions or not in the process, i. e., whether or not it obtains the results as prescribed by the patent and by this Court, whether or not upon agitation a mineral-bearing froth comes to the surface. This Court did not so hold. What it did hold will now be considered.

In the Hyde case the defendant used oleic acid, the only specific oily substance named in the specification of the patent in suit, and no other oily substance. No question did or could arise, therefore, in considering infringement in the Hyde case as to what would have happened if the defendant had used another or other oily substances. Indeed the only question, on infringement, was whether this oily substance, which is not an oil, but a fatty acid having the physical characteristic of "preferential affinity for metalliferous matter over gangue" (which is a characteristic of all oils, but not by any means a characteristic of all acids), was the equivalent of an oil, so that it would be covered by claim 12, which specifies an "oil." Claims 1, 2 and 3 specify "an oily liquid having a preferential affinity for metalliferous matter," and this clearly describes and includes oleic acid, although it also includes any other oily liquid having the described characteristic and capable of effectuating the process pointed out in these claims, which specify "agitating the mixture until the oil-coated mineral matter forms into a froth." Claims 5, 6 and 7 specify oleic acid, and specify "agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith".* On the other hand claim 12, in specifying an "oil" does not describe oleic acid, since oleic acid is a fatty acid and not chemically or in name an oil (although

*Thereby accentuating the vigorous agitation necessary with this viscous oily liquid.

physically not distinguishable from an oil), and when this Court decided, in the Hyde case, that Hyde's use of oleic acid infringed claim 12, it decided that, in the process in suit, "oleic acid" was the equivalent of an "oil", but it did not decide that every oil was the equivalent of oleic acid in the process. It also may be noted that claim 12 also includes the mineral-froth-forming characteristic, which was the only new function of oil in the process, in specifying "agitating the mixture to cause the oil-coated mineral to form a froth." It may also be noted that no question was raised by either party in the Hyde case as to oleic acid being the equivalent of an oil in the process. Nevertheless, this Court decided in the Hyde case, *sub silentio*, that oleic acid was, in the process, an equivalent of an oil, this being necessarily involved in decreeing that its use infringed claim 12 of the patent in suit.

Judge Hunt in the above quotation speaks of "oils which the patents authorize the use of," undoubtedly referring to the patent in suit. His conclusion that the patent in suit covers and includes as an infringement the use of kerosene and fuel oil cannot be founded upon what was decided by this Court in the Hyde case, since no such question did or could arise in that case. It cannot be founded upon what was said in the opinion of this Court in the Hyde case, for this Court approved of the only direction of the specification for determining what "different oily substances" than oleic acid were capable of effectuating the process, viz., that "with different ores and with different oily substances" (Spec., p. 1, lines 63, 64), "a simple preliminary test is necessary to determine" in each instance "which oily substance" will effectuate the process with that ore. This is a caution to the metallurgist to determine by test the capability of any oily substance to effectuate the process. This part of the specification was considered by this Court in connection with the attack upon the specification as an insufficient disclosure, and this Court said (242 U. S., 271):

> "The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible

> to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law."

This Court decided, therefore, in the Hyde case that the caution and direction to the metallurgist to determine by test, as to each ore, what oil or oils were capable of effectuating the process with that ore, was a proper disclosure of the invention and a proper instruction to those skilled in the art, for determining whether or not an oily material not named in the specification was an oily material of the patent—was capable of producing, when the pulp of a particular ore was agitated and aerated with it, a metalliferous air-froth of the metallic particles of the ore. Such a test determines that kerosene and fuel oil are not oils of the patent with defendant's ore. This Mr. Higgins demonstrated in Court by positive experiments, first with kerosene alone in the proportion of one-tenth of one per cent. on the ore (Vol. V, p. 2544, Qs407-416) and then with kerosene mixed with fuel oil in defendant's proportions (p. 2545, Qs423-426; p. 2548, Qs444-447; p. 2549, Qs458-461). Describing the result Mr. Higgins testifies that in the first case "everything is sunken" (p. 2544, Q416), and in the second case the result was of no value whatever metallurgically (p. 2549, Q461). There was no contradiction of this evidence. Defendant also demonstrated this fact, negatively, by its inability to run its mill with kerosene and fuel oil and without pine oil—the mineral-froth-forming oil. Without attempting here to array the overwhelming evidence on this subject (see Supp. Brief, pp. 127-140) it is enough to state that no mill has ever been run with kerosene or fuel oil as a mineral-froth-forming agent notwithstanding the cheapness and availability of these oils, especially fuel oil.

It is clearly evident, therefore, that Judge Hunt was mistaken in his belief that this Court had determined in the Hyde case that no discrimination was to be had between different oils in determining whether or not they were capable of effectuating the patented process. To the contrary this Court expressly approved the method of determination by test described in the specification; and on the evidence it is clear from this determinative method that kerosene and fuel oil are not oily liquids capable of effectuating the process, and are therefore not oils which the patent prescribes and covers the use of. The trial court so found (*supra*, pp. 49-51) and the Circuit Court of Appeals did not specifically reverse that finding.

Judge Hunt, in putting forward his own interpretation of the patent, appears to have been misled by the use in the specification of the words "preferential affinity for metalliferous matter over gangue" in describing one of the necessary qualities of such "fatty acids, or other substances" (Spec., p. 1, lines 13, 14) as could be used in the process in place of a suitable oil, and also appears to have been misled by the words "oily liquid having a preferential affinity for metalliferous matter" appearing in claims 1, 2 and 3. He says, as above quoted "To oily liquids which have 'a preferential affinity to metalliferous matter' must the plaintiffs be held" (Vol. 6, p. 3108; Appendix to Petition, p. 35). He apparently intended to quote the words which he placed within quotation marks from claims 1, 2 and 3 of the patent. The fact is that their only significance in specification or claims, is in prescribing that any fatty acids or other substances (not oils) used as mineral-froth-forming agents in the process of the patent in suit, must have what is a characteristic of all oils, viz.: a preferential affinity for metalliferous matter over gangue. If they have not this characteristic they cannot function in the process in suit. But the use of this qualifying phrase as to fatty acids and other substances, has no bearing whatsoever on the other and *new* essential function, clearly insisted upon in the specification and claims of the

patent in suit, as to oils, fatty acids and other substances, that they must, upon agitation with an ore pulp, produce a froth of "oil-coated mineral," as exactly stated in claims 1, 2, 3 and 12, and included by disclaimer in claims 9, 10 and 11.*

The statement in the specification to which Judge Hunt refers, is in fact the opening statement of that document and in full is as follows:

> "This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue" (Spec., p. 1, lines 9-15).

This is a broad statement of the classes of substances to which the invention may be applied and of the classes of substances which may be used in applying the invention. It is no more a guarantee that all substances which "have a preferential affinity for metalliferious matter over gangue" will effectuate the process than it is that all "ores" may be concentrated by the process. Neither is true, nor would either be expected to be true from this statement. It is merely a statement of the domain of technology to which "this invention relates," and the general "object" of the invention, as was recognized and stated by this Court in the Hyde case, as follows (242 U. S., 263):

> "As stated in the specification, the claimed discovery of the patent in the suit *relates* 'to improvements in the process for the concentration of ores, the *object* being to separate metalliferous matter from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for such metalliferous matter over gangue.' "

*Claims 5, 6 and 7, the oleic acid claims, need not be here considered, because not infringed by the acts of the defendant, after the decision of this Court in the Hyde case, employing pine oil, kerosene and fuel oil; but these claims particularly specify "agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and formed a froth therewith," accentuating the vigorous agitation necessary with this viscous oily liquid.

Thus this Court clearly said that this statement of the specification merely called attention to what the invention relates to and what its object is.

This statement of the specification is followed by a general description of the discovery and of the nature of the invention, and then by the caution and direction to the metallurgist to determine by test the capability of any oily substance to effectuate the process with any ore. This again is followed by a specific example of the application of the invention in the concentration of a particular ore, to wit: Broken Hill ore, by the use of a particular fatty acid having a preferential affinity for metalliferous matter over gangue, to wit: oleic acid.

As to the claims, it may be noted that the only claims which contain the words "oily liquid having a preferential affinity for metalliferous matter" are claims 1, 2 and 3, the "oily liquid" claims. Judge Hunt does not mention the fact that the "oil" claims, claim 12, and claims 9, 10, 11 as limited by disclaimer,* do not contain the words "having a preferential affinity for metalliferous matter" to describe the oil. These claims and all the claims set forth the function and results of the process (claims 9, 10 and 11 as limited by disclaimer). Apparently, however, Judge Hunt extends claims 9, 10, 11 and 12 to cover every oil, effective or ineffective, because of his erroneous interpretation of the language of the specification, and because of his erroneous construction of claims 1, 2 and 3, and because of his erroneous view that this Court, in the Hyde case, held that the patent did not discriminate between *oils that would* and *oils that would not* effectuate the process.

Judge Hunt's opinion as to this error of law has been fully considered here because his is the only opinion of the Judges of the Circuit Court of Appeals which discusses it. His errors may be summed up as:

*It is to be noted that although Judges Ross and Hunt do not discuss the disclaimer, their eventual affirmance of the decree below as to infringement prior to January 7, 1917 (see "Order Modifying Decree," Vol. VI, p. 3113, Appendix to Petition, p. 42), necessarily validated claims 9, 10 and 11 as limited by the disclaimer.

(1) his erroneous statement that this Court decided that no discrimination was to be had between known oils, vegetable, animal or mineral;

(2) his own erroneous conclusion that the specification and claims of the patent in suit must be construed as prescribing the use in the process of, and thus including in the process as described and claimed, all oils and oily liquids having a preferential affinity for metalliferous matter whether capable of effectuating the process or not.

Judge Ross (Vol. VI, p. 3103; Appendix to Petition, p. 24) quotes a part of the opening statement of the specification above fully quoted, and comments that, of the claims in issue, "not one specifies any particular kind of oil" (which overlooks the fact that every claim specifies by function and results the essential mineral-froth-producing quality which identifies the kind of oil or oily liquid required) "although the fifth and sixth" (and he should have added the seventh) "specify as one of their constituents 'a small proportion of oleic acid * * * amounting to 0.02 to 0.5 per cent. on the ore.'" In this quotation he inserts in brackets after "oleic acid" the statement that it is an acid existing in most fats in combination with glycoral. This is undoubtedly true. Oleic acid is a fatty acid and is not chemically an oil. Nevertheless it is a viscous oily liquid, not distinguishable, physically, from an oil, and it was the first oily liquid used in the process in suit, at the birth of the invention, and its use has continued to some extent. It was the only oily liquid used by the defendant Hyde in the infringing operations described in the evidence in the Hyde suit. It was used by the defendant in the instant case in the infringing operations proved in the Hyde suit (which were in the present defendant's plant, with its ore and for its profit), and it was continued in use by the present defendant for three and a half years, until the superior adaptability of pine oil for use with defendant's ore, and possibly the greater availability of pine oil, determined the use of pine oil alone; since which time, December, 1914, defendant has not used

oleic acid. Its use, therefore, is largely in issue, although only in admitted infringement, and its use was adjudged by Judge Ross to be an infringement of the patent in his opinion as finally amended (see "Order Modifying Decree," Vol. VI, p. 3113, Appendix to Petition, p. 43).

But although Judge Ross refers to and partly quotes the statement of the specification adverted to by Judge Hunt, he does not discuss it, nor does he discuss anything bearing upon this first error of law. His entire discussion deals with the second error of law.

In the partly dissenting opinion of Judge Morrow there is also no discussion of the first error of law. He merely expresses the conclusion that "the use of oil or oily liquid in a quantity amounting to more than a fraction of one per cent, on the ore is not within the terms of claims 1, 2, 3 and 12, and is therefore not an infringement" (Vol. VI, p. 3109; Appendix to Petition, pp. 37, 38). He is silent as to the reason for his inclusion of every oil and oily liquid within this statement. He is clear and forceful in his dissent from the second error of law. He also discusses the disclaimer and holds it to be a proper disclaimer timely filed, and claims 9, 10 and 11 valid as limited by the disclaimer (and so do Judges Ross and Hunt hold, *sub silentio,* in adjudicating the validity of the patent), but he does not discuss infringement of claims 9, 10 and 11 as thus limited. His expressed views, including his interpretation of the decision of this Court in the Hyde case, however, make the disclaimer limit these claims to the *use* of a fraction of one per cent. of any and every oil.

Second Error—Oil-quantity limitation. By this error Judges Ross and Hunt leveled off all the claims in issue to the upper quantity level of the claims for the specific example given in the specification, one-half of one per cent. (0.5%) on the ore, with the only oily liquid named in the specification, oleic acid, and the only ore specifically described in the specification, Broken Hill ore. This is the upper limit of claims 5, 6, and 7, and Judges Ross and Hunt have imposed it as an upper limit on claims 1, 2, 3, 9, 10, 11 and 12. In construing claims

for a process, if a quantity limit is placed upon the use of one of the materials in the process, careful thought must be given as to whether or not an artificial barrier is erected which merely has the effect of enabling one who wishes to pirate the invention to step just outside of that artificial barrier and escape the letter of the claim, while obtaining substantial advantages from the use of the invention. The Circuit Court of Appeals has erected this artificial barrier at one-half of one per cent. as to claims 1, 2, 3, 9, 10, 11 and 12, because of the expressed belief of Judges Ross and Hunt that the decision of this Court in the Hyde case compels it. The fundamental basis for this erroneous conception appears to be in the concluding language of the opinion of this Court in the Hyde case, wherein the confinement imposed upon the patent is stated.

Judges Ross and Hunt appear to have given no attention whatsoever to the careful analysis in the opinion of this Court of the prior art processes and the process in suit, and the conclusions there stated. This Court contrasted the process in suit with the prior art processes, and said that in the process in suit a new function of oil was utilized (namely, its froth-forming function as contrasted with buoyancy or agglutination), that a new mode of operation was introduced in the selection and lifting of the metallic particles of the pulp (namely, the buoyancy of air bubbles as contrasted with that of oil), and that a new result was obtained (namely, a froth composed of air bubbles modified by the presence of a minute trace of oil in them and carrying a high percentage of the metal and metalliferous particles of the ore treated, as contrasted with an oil-float carrying metal particles in the oil, or with the sinking of agglutinated granules). Nor do they appear to have considered the conclusion stated by this Court, as to novelty and patentability, that the process in suit (242 U. S., 266)

> "differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery."

The concluding clause of the opinion of this Court is quoted by Judge Ross, with an interpellation as follows (Vol. VI, p. 3103; Appendix to Petition, p. 26):

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (the former patents having used so much oil as to make its cost prohibitive—our observation) (The Barbed Wire patent, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

This was followed in the opinion of this Court by the statement (242 U. S., 271),

> "and, therefore, the decree of this court will be that the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7, and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."

Petitioners have heretofore commented upon the significance of this interpellation as indicating the view of Judge Ross that the final step "which converted experiment into solution, 'turned failure into success'" was merely a saving in the cost of the oil used, this being a persistence in the error of the former decision of his own court in the Hyde case in which he concurred (*supra*, p. 59). Judge Ross follows the above interpellated quotation from the opinion of this Court by the following statement (Vol. VI, pp. 3103, 3104; Appendix to Petition, pp. 26, 27):

> "Amounting to *a* fraction of one per cent. on the ore is very far from saying amounting to *every* fraction of one per cent. on the ore; *a* fraction is one thing, *every* fraction is a very different thing. It is obvious, we think, that if the Supreme Court had meant to extend the scope of claims

> 1, 2, 3, 5, 6, 7 and 12 of the patent to *one per cent.* of oil on the ore, as is here contended by the appellees, it would not have said anything about any fraction of one per cent.—certainly there would have been no necessity for doing so, and certainly the use of such specific language as is employed without a purpose cannot be justly imputed to that great tribunal" (italics by Judge Ross).

It should be first noted that claims 5, 6 and 7, the "oleic acid" claims, are by their language limited to one-half of one per cent. of oleic acid on the ore, and petitioners (appellees before the Circuit Court of Appeals) did not contend that those three claims should be broadened beyond their terms. Their scope-defining language relative to quantities of oleic acid is

> "a small proportion of oleic acid amounting to 0.02—0.5 per cent on the ore."

Claims 1, 2, 3 and 12, however, have no such limitation as to quantities of oily material and oil.

Claims 1, 2 and 3, the "oily liquid" claims have as their scope-defining language relative to quantities of oily liquid—

> "a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore)."

Claim 12, an "oil" claim, has as its scope-defining language relative to quantities of oil—

> "a fraction of one per cent. of oil on the ore."

It appears, therefore, that the words "amounting to a fraction of one per cent. on the ore" which this Court quoted in its opinion, were exactly quoted from claims 1, 2 and 3 of the patent, and substantially repeat the language of claim 12. And this Court specifically refers to them as descriptive language of the claims.

Judge Ross attributes great significance to the fact that this Court used the expression *a fraction* and did not say *every*

fraction, but he overlooks the fact stated in the opinion, that these words were quoted from the claims of the patent, and that the employment of the expression "a fraction" in a claim of a patent has the legal effect of limiting and defining the scope of the claim just to the extent that everything that comes within the proper purview of the language is included and covered by the claim. And this is particularly true when we find, in the same patent, broad claims using the expression "a fraction of one per cent.," and narrower claims defining an upper limit of one-half of one per cent.

When this Court adjudged claims 5, 6 and 7 to be valid, your petitioners have no doubt that it adjudged them valid to the full extent of the scope of their language, in this instance, as to oleic acid quantities, to an upper limit of one-half of one per cent.

When this Court adjudged claims 1, 2, 3 and 12 valid, petitioners have no doubt that it adjudged them to be valid to the full extent of the scope of their language, in this instance, as to oily liquid and oil quantities, "amounting to a fraction of one per cent. on the ore," at least every quantity less than one per cent., which would come within the other descriptive language of the claims. Certainly if this Court had intended to limit claims 1, 2, 3 and 12 to the upper limit of claims 5, 6 and 7, as Judges Ross and Hunt conceive, it would have said so as Judge Morrow aptly says (Vol. VI, p. 3110; Appendix to Petition, p. 39):

> "Had the Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one-half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in Claims 5, 6 and 7. For what purpose does the Court hold Claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions 'amounting to a fraction of one per cent. on the ore' that is to say upon ores generally."

The words "critical proportions" are not quoted by this Court from the patent nor from the claims. They appear to be modified and qualified by the words immediately following them "amounting to a fraction of one per cent. on the ore." Their significance would seem to be that they are the mineral-froth-forming proportions of an oil or oily liquid that will effectuate the process described in the claims and obtain the new results thereof.

The Circuit Court of Appeals has referred to the privately printed arguments made in behalf of petitioners in this Court in the Hyde case in interpreting the opinion of this Court as to "critical proportions." While not attaching any significance to the privately printed arguments as an aid to interpreting the decision of this Court, petitioners, for the convenience of the Court, present the following brief extracts from these arguments.

It was said by Mr. Williams, counsel for petitioners, in the argument before this Court, that argument being of necessity based upon the evidence that had been taken in that case on the issues there involved (Oral Arguments, pp. 11, 12):

> "Then the patent takes up one matter which requires explanation. This is a general process of ore concentration, and *every ore presents its own problem.* That is well known in the art. Judge Bourquin, who lives in the town of Butte, Montana, and knows a great deal about mining, very well expressed in his decision the facts as to the necessity of testing the use of different oils with different ores. I will just read from our brief at page 41 what Judge Bourquin said:
>
> 'It is true every ore presents its own problem of reduction, so while all may lend themselves to a general method, each may require some modification of that method. All skilled in the art understand this and know that in addition to the best scientific theory they must add the light given by trial and practice. Thus only in the majority of cases are good and the best results obtained in any ore reduction, smelting, milling or concentration.'

The amount of oil that we use is generally one-tenth of one per cent. on the ore; two pounds of oil to the short ton of ore. *Every ore presents its own problem, but for a given ore and a given oil there is a certain critical factor.* The variations in that factor *in practice have been* from a trifle less than one pound of oil to the long ton in the case of the rich ores of Australia to four pounds of oil to the long ton in the case of a lean copper ore at the Braden mines in Chile. Those are the variations of different oils and different ores, and because of those minute variations you have the *impossibility of saying that this process always uses just so much;* but given any ore and given any oil, the evidence shows that if you add another pound of oil your metal particles commence to stick together and commence to fall down in granules, and you get into the Cattermole sinking sphere, whereas, on the other hand, if you diminish it, you cease to have that selective action which is essential; you do not get any float in particular and you have gangue in it; *so that it is critical for a given oil and a given ore, but it has variations.*

Mr. Justice Pitney: Is a practical test necessary to determine the particular proportion of oil and ore to be used in each case?

Mr. Williams: Yes. A practical test.

Mr. Justice Pitney: Is that test very readily made?

Mr. Williams: It is very readily made. We make those tests in our laboratory day in and day out.

Mr. Justice Pitney: You are able to tell your customer before he takes the process what the percentage will be?

Mr. Williams: Yes.

Mr. Justice Pitney: By your own tests of the material?

Mr. Williams: Yes.

This briefly presents the substance of the arguments on this point which were presented by petitioners to this Court in the Hyde case. The references to that subject in the brief are wholly consistent therewith. All are founded upon and limited to the facts as shown by the evidence in the Hyde case.

In behalf of the defendant and respondent in that case, in response to an inquiry of the Chief Justice as to the oil proportions of the patent in suit, Mr. Scott said (Oral Arguments, p. 39):

"Well, the patent in suit says a fraction of one per cent. Therefore, presumably, it includes everything from an amount infinitely smaller than one per cent., down to zero * * *."

This range includes any and every quantity of oil less than one per cent. on the ore.

These arguments are here quoted merely to show what arguments were made before this Court.

In its decision this Court said (242 U. S., 270, 271):

"Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that *when different ores are treated preliminary tests must be made to determine the amount of oil* and the extent of agitation necessary in order to obtain the best results. *Such variation of treatment must be within the scope of the claims,* and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject-matter. *The composition of ores varies infinitely, each one presenting its special problem,* and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. *The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims,* while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law."

It is submitted that this Court held that the "critical proportions" as to any ore and any oily liquid that will effectuate the process with that ore, are such amounts as are found to be necessary, within the scope of the claims, under the conditions present when the process is carried out with that oil and that ore, and that they are not absolute but are variable quantities, depending upon the conditions in each case. In the Hyde case defendant used 0.16% of oleic acid under conditions of agitation produced in mechanical appliances substantially the same as those then used by petitioners, so that the

process as practiced by plaintiffs and defendant in that case, was the same in all respects. Since the testimony was closed in the Hyde case, in 1912, great advances have been made in the extensive use of the process, including variations in the mechanical appliances or containers or cells wherein the ore pulp is treated. As Judge Bourquin says, in his opinion in the instant case (Vol. I, p. 100):

> "It is noted that the process is responsible for advance in methods, devices and machines for its operation."

Judge Bourquin also mentions conditions which will vary the critical proportions. He says (p. 95):

> "There are 'critical proportions' of any oil used in this process, *perhaps not a sharp divide but rather a broad one.* For the amount of oil to produce sufficient and efficient bubbles must depend on many other factors, viz: the working cell space, amount of water, degree of agitation, kind and amount of ore and perhaps on occasion amount of metallic content, kind of oil," etc.

We respectfully submit that this Court in the Hyde case when it spoke of critical proportions referred to the amount of oil which in any given case, within the scope and terms of the claims, would effectuate the process, and that there is nothing in the opinion of this Court in the Hyde case which can be construed as limiting the patent or the claims in respect of critical proportions to anything less broad in its scope than the terms of the claims. In other words, this Court was speaking of critical proportions within the claims, and not of critical proportions as limiting the claims.

There is a long quotation in Judge Ross' opinion from the recital (Vol. VI, p. 3104; Appendix to Petition, pp. 27, 28) in the opinion of this Court of the history of the making of the invention, where, in the use of oleic acid on Broken Hill ore, under the particular conditions of grinding, acidifying, heating, and agitation there present, the reversal, from the Cattermole metal-sinking result to the patentees' novel floating

metal-froth result, occurred at or about one-half of one per cent. of oleic acid on the ore, in the gradual reduction of the quantity of oleic acid used.

But that recital occurs in the course of the consideration by this Court of the question of invention, and as supporting the holding of this Court that invention was involved. The *particular* point (approximately one-half of one per cent. of oleic acid to ore) where, in that particular case, the invention began to appear, was not germane to the general argument of invention, and is important only to one who is using oleic acid with Broken Hill ore under the conditions then present, and does not in any way affect or limit the claims of the patent other than claims 5, 6 and 7.

The opinion of Judge Ross also quotes (Vol. VI, p. 3106; Appendix to Petition, pp. 30, 31) a colloquy between Justices of this Court and counsel for petitioners at the argument in this Court of the Hyde case (Oral Arguments, p. 85) wherein this argument of invention was being made. It is a demonstrated fact that the results obtained by the process in suit cannot be obtained, in any practical ore-concentrating operations, under the particular conditions present at the birth of the invention, with more than one-half of one per cent. of oleic acid. True, by plant manipulation, some sort of floating material, a few of the granules, may be brought to the surface, but the process cannot be carried on under those conditions. This was brought out by Mr. Justice Pitney's first inquiry in that colloquy as follows (Vol VI, p. 3106; Appendix to Petition, p. 31):

> "Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day, to the effect that 1.8%, or perhaps more, of oil would give the same result with increased agitation?
> "Mr. Williams: Absolutely no.
> "Mr. Kenyon: It would not."

Mr. Scott in his oral argument had repeatedly referred to certain experiments by Dr. Liebmann with 1.8% of oil (Oral

Arguments, pp. 39-41). These experiments were with oleic acid and defendant's ore, and produced sinking granules, as appears in the record in the Hyde case stipulated in the record of the instant case (Vol. I, pp. 433, 434, Q36), but Mr. Scott had asserted that it was merely a matter of manipulation whether you obtain the floating froth of the patent or the sinking granules, that assertion having been based on experiments in miniature and not on practical operations. This is referred to merely to show that the entire colloquy related to oleic acid. And it is to be noted that defendant has never succeeded in using oleic acid in its mill in excess of one-half of one per cent. on the ore, so that the facts appear now as they appeared in the Hyde record as to all that was said in this colloquy.

It may be noted that this colloquy, as introduced in evidence in the instant case, does not include Mr. Justice Pitney's first question above quoted and what follows, as to 1.8% of oleic acid with defendant's ore (Vol. IV, pp. 2201, 2202; or Vol. VI, pp. 2947, 2948). Judge Ross evidently copied this colloquy from the brief of defendant (appellant before the Circuit Court of Appeals) wherein this addition was made without authority from the record (Brief for Defendant-Appellant, pp. 17, 18). The added part, however, was accurately copied from the printed Oral Arguments before this Court, and the fact that it was not in evidence merely serves to show the accuracy of Judge Morrow's statement that the colloquy as in evidence, "related to the use of oleic acid on Broken Hill ores" (Vol. VI, p. 3110; Appendix to Petition, pp. 38, 39). The entire colloquy and the argument which preceded it (which is omitted from Judge Ross' quotation), as in evidence herein (Vol. IV, pp. 2201, 2202; or Vol. VI, pp. 2947, 2948) was confined to the presentation of the evidence as to the birth of the invention, with oleic acid and Broken Hill ore. The part added in Appellant's Brief before the Circuit Court of Appeals and copied therefrom by Judge Ross, relating to oleic acid and defendant's ore, in fact, however, enforces the conclusion that

all participants to that colloquy were talking about oleic acid.

Judge Hunt also refers to this colloquy as quoted by Judge Ross, and probably correctly says that the object of the Justices of this Court in their inquiries "was to stamp precision upon the point *when invention in the process* began to appear" (Vol. VI, p. 3108; Appendix to Petition, p. 35; italics by Judge Hunt). But he altogether overlooks the fact that particular operations with particular materials were under consideration at the time, and that this Court, in its decision, clearly pointed out that the process was "one for dealing with a large class of substances," that "the composition of ores varies infinitely, each one presenting its special problem," and that in each case "preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results" (242 U. S., 270, 271), all as above fully quoted.

Judge Hunt also refers to the patent specification (Vol. VI, p. 3107; Appendix to Petition, pp. 33, 34), but appears not to appreciate that his reference is to the specific example of the specification, which describes a treatment of Broken Hill ore with oleic acid in a Gabbett under the conditions of agitation of the Cattermole process and with the pulp acidified and heated as directed. The part of the specification which he quotes commences with this statement (Spec., p. 1, lines 70-72):

> "The following is *an example* of the application of this invention to the concentration of *a particular ore.*"

He also refers to the evidence in the Hyde case (his only reference to testimony) and what he says is true as to the oil-quantity limits in practical work in the process as it appeared in that case, the example there being the same as in the patent. But it is submitted that no inference can be drawn from that example that this Court intended to confine all the claims of the patent to an upper limit of one-half of one per cent. Indeed, Judge Morrow's partly dissenting opinion may be here

referred to as a complete answer to his colleagues on this second error of law.

Judge Morrow's opinion, commencing with his reference to the opinion of this Court in the Hyde case (Vol.VI, p. 3109; Appendix to Petition, p. 38) down to his consideration of the disclaimer (Vol. VI, p. 3111; Appendix to Petition, p. 40), is a clear and forceful argument exposing the error of his colleagues as to the imputed confinement of the patent by this Court to the upper limit of one-half of one per cent. of oil or oily liquid. To quote it would be but to repeat what has been already said.

Errors in applying the Law as to Infringement. It is a fundamental inquiry on an issue of infringement *whether the defendant has taken the substance of the invention.** In the instant case the Circuit Court of Appeals, believing that the substance of the invention as defined by this Court consisted merely in a reduction of the amount of oil used in an old process without change in operation or principle of action or result (except as the cost of oil was saved), had regard only to that one arbitrary feature and paid no attention to operation or to principle of action or to result. But when the issue of infringement is tested by the substance of the invention as really defined by this Court, consideration must be given to the principle of action, the mode of operation, and the results obtained, in defendant's process. So tested it appears, and is not denied by defendant's witnesses, that in defendant's process a definite modicum of the total oil used (i. e., the pine oil) has the characteristic bubble-modifying action, that the mineral particles during the agitation become attached to the so-modified air bubbles and are lifted by the lifting force of the air, and that there results a mineral-air-froth the bubble films of which are modified by the modicum of pine oil in them and

*"It is the duty of courts and juries to look through the form for the substance of the invention—for that which entitled the inventor to his patent, and which the patent was designed to secure; where that is found, there is an infringement." Winans vs. Denmead, 15 How., 330.

carry in mechanical suspension a large percentage of the mineral of the ore, which froth is separated as by overflow from the underlying pulp containing the gangue.

A related and (if negatively answered) a confirmatory inquiry on an issue of infringement is *whether the defendant has really reverted to the prior art.* In the instant case the Circuit Court of Appeals, with the view it had of the prior art and of the relation of the invention to it, apparently believed, although it does not say so explicitly, that defendant had reverted to the prior art. But with the view of the prior art and of the invention expressed by this Court, it appears that defendant's process is neither the mineral-granule-forming and sinking process of the prior art (Cattermole) nor yet any of the surface flotation processes of the prior art (e. g., Kirby) with their floating of the mineral particles by the lifting force of the oil used and their holding of those particles in an oil-float on the surface of the pulp. There is no different prior art in the instant case. The unnecessary 18 pounds or so of fuel oil and kerosene which defendant adds to what without it would admittedly be the process of the patent in suit (which addition constitutes defendant's only concession to the decision of this Court in the Hyde case), is not only wholly ineffective to achieve the ore-concentration that is achieved, and substantially ineffective to prevent that concentration (although it diminishes its effectiveness), but is wholly insufficient in amount to introduce any oil-lift operation on the mineral particles or to bring about any mineral-carrying oil-float. There is a consensus of evidence that no oil-lift or mineral-carrying oil-float phenomena occur in defendant's process but that the action and operation and result are identical with those of the process in suit. Not only is defendant's process not identified by anybody with any one specific process of the prior art, but it does not belong to either of the classes into which this Court divided all the prior art oil concentration processes.

It is also fundamental on an issue of infringement where a defendant has made *an addition* to a patented process, to in-

quire *whether that addition has changed the principle of action or the mode of operation or the result.* In the instant case the Circuit Court of Appeals, because of its erroneous conception of the process, namely, that the process had no characteristic principle of action or mode of operation or result, but consisted merely in an arbitrary saving in the amount of oil used, did not apply this test at all, but merely counted all oils used, regardless of the effect or non-effect of their use, as so much oil *not saved.* It appears, however, that the addition of the fuel oil and kerosene in defendant's process has no effect whatever to change the principle of action, or the mode of operation, or the results obtained. Financially the added oil costs more money and the concentrates obtained from given ore do not bring as much money, but metallurgically and technically and actually the process without the addition and the process with the addition are identical processes and it is so testified and was so admitted by defendant's counsel at the trial.*

The doctrine of *equivalents* is, under settled authority of this Court,** given wide range in the case of process inventions, especially inventions that are primary in character and have revolutionized an old or created a new art and have benefited mankind, as by conserving or making more available the mineral resources of the earth. In the instant case the

*Defendant, in the District Court, in its oral argument, made the following admission (Oral Arguments of Defendant, p. 34):

"Now, I maintain that it has been satisfactorily proven by our witnesses, Professors Bancroft, Sadtler, Taggart and Beach, that there is no difference between the action of plus one per cent. of oil and minus one per cent. of oil in any respect that science can develop, and technically there is no difference. Our mill operations as set forth in these tabulated statements which we have introduced and in testimony of our witnesses show that there is no difference from a technical and commercial viewpoint. It is a case in which practice and theory are in absolute agreement."

The only error in this admission was from the "commercial viewpoint." The defendant in the District Court contended that its operations with one per cent. of oil or more were just as profitable as its operations with less than one per cent. of oil. In the Circuit Court of Appeals, however, a loss at the rate of about $1,000,000 a year was admitted (supra, p. 26 ¶ 30).

**_Mitchell_ vs. _Tilghman_, 86 U. S., 287.
Morley vs. _Lancaster_, 129 U. S., 263, 273.
Carnegie vs. _Cambria_, 185 U. S., 403.
Miller vs. _Eagle_, 151 U. S., 186, 207.

defendant's process is within the very letter of the claims, having regard to the substance of things, and to the work that is done, but if it were not so, the oil mixture employed by defendant would be a full equivalent in the process, under the law and the authorities, for the oil of the patent, because it accomplishes the same result in the same way on the same principle of action and by the same means (to wit, by the minute fraction of one per cent. of pine oil on the ore with agitation and aeration, etc.). In the conception of the invention held by the Circuit Court of Appeals in the instant case there was no place or room for any doctrine of equivalents, because the invention so conceived had no basis in novelty of principle, operation or result, and its limitations were therefore purely arbitrary. But the conception of the invention expressed by this Court, as characterized by a new principle of action of oil, and a new mode of operation of air bubbles, and a new result of the process, namely, a mineral-holding air-froth, not only gave a basis in reason for upholding the patent as for a patentable invention, but gives a basis in reason for determining on an issue of infringement what is a difference of substance and what a mere difference of form without substance, what variant is an equivalent and what a real departure.

Attention should be "given to such portion of a given device as really does the work," says this Court in Union Paper Bag Co. vs. Murphy, 97 U. S., 120, 125.

If "all the *efficient* elements of the combination are retained" and if the "organization is essentially the same," there is infringement (*O'Reilly* vs. *Morse*, 15 How., 62, 124)

"a charge of infringement is sometimes made out, though the letter of the claims be avoided" (*Westinghouse* vs. *Boyden*, 170 U. S., 537, 568).

Patents "are to receive a liberal construction, and under a fair application of the rule, *ut magis valeat quam pereat*, are, if practicable, to be so interpreted as to uphold and not to destroy the right of the inventor" (*Turrill* vs. *R. R. Co.*, 1 Wall., 491, 510; *Topliff* vs. *Topliff*, 145 U. S., 156).

Construction of Claims. Aside from all questions of substance and equivalents, and having regard only to the letter of the claims, in the instant case defendant has always employed so small a quantity of the *oil or oily liquid of the patent* as to be well within even the narrowest of the claims of the patent and well within the quantity limit prescribed by the Circuit Court of Appeals. But if the question of quantity limitation of the claims of the patent should ever arise (as by an infringer using 22 pounds of pine oil, for example) it would be observed that the claims in issue as to phraseology in this regard range themselves into four different groups, as follows:

1. Claims 5. 6 and 7 which specify one-half of one per cent. as the upper limit (of oleic acid).

2. Claim 12 which specifies "a fraction of one per cent." (of oil). Inasmuch as any fraction up to but not including a full one per cent. is "a fraction of one per cent." the upper limit cannot be lower than just under one per cent.

3. Claims 1, 2 and 3 which specify "a small proportion" (of oily liquid) and add parenthetically "(amounting to a fraction of one per cent. on the ore)." These claims by contrast with Claim 12 and in line with the specification page 1, lines 28-30, might very properly be construed on the assumption that the parenthetical clause is descriptive and not limitative, i. e., is an example corresponding to the example of the specification "—say to a fraction of one per cent. on the ore—"

4. Claims 9, 10 and 11 as limited by disclaimer, which specify "a small quantity," but are limited by the disclaimer to such a small quantity as obtains the characteristic resulting froth concentrate, and proceeds by the characteristic air-lift operation and on the bubble-modifying principle of action of the oil, all as set out by this Court.

So construed the several groups of claims are progressively broader in the matter under consideration.

The holding of this Court that the patent "must be confined to the results obtained by" etc., was not a holding that the patent was to be construed as for the "results" *per se* but for the process *as identified by the results.* And the results specified by this Court as characteristic and identifying (the result-

ing froth concentrate—consisting of modified air bubbles holding the mineral particles) require and so presume the characteristic air-lift operation which this Court also sets out as distinguishing the process from all prior processes, and the characteristic principle of action of the oil or oily substance in air-bubble forming and modifying.

Disclaimer.

The disclaimer was filed March 28, 1917, following the Mandate whereby the decree of this Court became effective, issued on January 13, 1917. The time taken for consideration of this action was about seventy days, allowing for mail transmission and was remarkably short when one considers the magnitude of the questions involved in the making of this disclaimer, the fact that counsel during this period argued the appeals in the Third Circuit Court of Appeals in the Miami case, prepared and filed reply briefs therein, and then prepared for trial of the present case.

This Court did not, as courts sometimes do, direct the filing of a disclaimer. A disclaimer is an affirmative act of abandonment by the patentees, an estoppel by matter of record. This subject required and received the most careful examination and consideration, and on March 27, 1917, the document was executed and forwarded to the Patent Office. The patentees' right to petition this Court for a rehearing as to claims 9, 10 and 11, and defendant's right to petition for a rehearing as to the other claims in issue, had not expired and would not expire for several months, at the time that this action was taken.

This Court having reached the conclusion that the patent must be confined in a certain way, and having also reached the conclusion that as to claims 9, 10 and 11 it was not confined in that way, decreed the patent invalid as to those claims. Claims 9, 10 and 11 were therefore condemned because they were too broad. The purpose of the disclaimer is to cut off all the excess by reason of which those claims extended beyond the subject-matter to which this Court said it must be confined (U. S. R. S., Sections 4917, 4922).

The disclaimer in its recital (Vol. I, pp. 60, 61) refers to the decision of this Court as advising the petitioner that the patent "in so far as concerns claims 9, 10 and 11 thereof, covers and includes more than" the "inventors had a right to claim as new," that such excess "was included therein by mistake, and without fraudulent or deceptive intent, and without any wilful default or intent to defraud or mislead the public," that "the subject-matter not herein and hereby disclaimed is definitely distinguishable from the part or parts disclaimed herein, and is truly and justly the invention of the" inventors "and is a material and substantial part of the thing patented," and therefore that the petitioner, "for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your petitioner does not choose to claim or hold by virtue of" the patent

> "does hereby disclaim from claims 9, 10 and 11 of said letters patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

The disclaimer employs the very language of the decision of this Court which is here quoted (242 U. S., 271):

> "the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of 1 per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."

The validity of this disclaimer was fiercely contested at the trial. Judge Bourquin's findings and conclusions thereon have heretofore been briefly referred to (*supra*, p. 46) but will now be fully quoted (Vol. I, p. 99):

> "The disclaimer to conform to the Supreme Court's decision that claims 9, 10 and 11 are invalid, was filed 107

> days after said decision and after mandate but before expiration of time for rehearing. It was timely filed. In substance it fairly conforms to the language of the decision, disclaiming 'from claims 9, 10 and 11 * * * any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of 1 per cent. on the ore.' The parties differ in its interpretation even as they do in respect to the decision. Written words, not oral claims, control. The patent claims included what the patentees were entitled to and more. The decision pointed out the excess. The patentees disclaimed the excess. They can safely rely upon the decision and a disclaimer conforming to the language of the decision is sufficient."

The difference in descriptive language between claims 1, 2, 3, 5, 6, 7 and 12 on the one hand and claims 9, 10 and 11 on the other hand as to the *"results"* to be *"obtained,"* is that in all the claims of the former group it is prescribed that the froth must be formed or constituted *by the oil-coated mineral particles,* whereas in all the claims of the latter group the only prescription is that "a froth," not necessarily a mineral froth, is to be formed. Thus claims 1, 2 and 3 say agitate

> "until the oil-coated mineral matter forms into a froth";

and claim 12 says agitate

> "to cause the oil-coated mineral to form a froth";

and claims 5, 6 and 7 say agitate

> "until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith";

whereas claims 9, 10 and 11 merely say agitate

> "to form a froth."

Thus claims 9, 10 and 11 before disclaimer were not limited, as the other claims were, to a process which obtained as its result a froth consisting of, that is, formed by, the oil-coated mineral matter.

The difference in descriptive language between these two groups of claims *in the matter of oil quantity* is as follows:

Claims 5, 6 and 7 specify

> "a small proportion of oleic acid amounting to 0.02—0.5 per cent on the ore";

Claim 12 specifies

> "a fraction of one per cent. of oil on the ore";

Claims 1, 2 and 3 specify

> "a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore);' "

whereas claims 9, 10 and 11 specify

> "a small quantity of oil."

The disclaimer was held valid by Judge Bourquin, as above noted, and as construed by him it limited claims 9, 10 and 11 to the use in "beneficial service" "of a fraction of 1 per cent of oil on the ore" (Vol. I, p. 101).

The disclaimer was also held valid by Judge Morrow (Vol. VI, p. 3111; Appendix to Petition, pp. 40, 41). As he construed it the limitation imposed was to

> "the use of oil within the proportion 'amounting to a fraction of one per cent. on the ore.' "

According to the context this was a limitation to the use of any oil or oily liquid in such quantity, whether or not it effectuated the process.

He also said

> "Such language was strictly in accordance with the decision of the Supreme Court and I think, a sufficient rejection of the excess from the invention claimed, leaving the patent in the form limited by the opinion of the Supreme Court."

Judge Morrow also said (Vol. VI, p. 3111; Appendix to Petition, p. 41):

> "With respect to the objection that the disclaimer was not filed in time, the mandate of the Supreme Court became effective January 13, 1917, decreeing the patent to be invalid as to Claims 9, 10 and 11, but valid as to the other claims in issue. On March 28, 1917, the plaintiffs filed their disclaimer, some time before the right to petition for a rehearing in the Supreme Court had expired. Considering the importance of the procedure to be followed, the residence of the patentees in another country and the consequent delay in communication, the date of filing was not unreasonably delayed."

The majority of the Circuit Court of Appeals did not discuss the disclaimer. The initial decision of the majority ordered that the case should be returned with instructions that the bill be dismissed "without regard to the question raised respecting the sufficiency of the disclaimer filed by the appellee's company or its resultant effect" (Appendix to Petition, p. 32, footnote). In the Order modifying the decree (Vol. VI, p. 3113; Appendix to Petition, p. 43) it is stated that "in reversing the judgment of the court below we directed that court to dismiss the bill at the complainant's cost," and reference is made to the admission of infringement by the defendant prior to and including January 7, 1917, which the court had overlooked in deciding the case, and then it is ordered that the decree then on file be corrected to the form in which it is now printed (Vol. VI, p. 3112). The opinion of Judge Ross then on file was also corrected to the form in which it is now printed, with a conclusion in the language of the order modifying the decree substituted in place of its conclusion as originally filed (Appendix to Petition, p. 32, footnote). Thus by its action the Circuit Court of Appeals adjudged the validity of the disclaimer—one Judge (Morrow) distinctly affirming its validity, and the other two necessarily affirming its validity in the judgment which they rendered. The result of the

opinions of the three Judges of the Circuit Court of Appeals, was that two of them confined claims 9, 10 and 11 as limited by disclaimer, to the use of any oil or oily liquid in an amount not exceeding one-half of one per cent. on the ore, and the other thereof (Judge Morrow) confined these claims to the use of any oil in any and every fraction of one per cent.

In each instance the construction placed upon the disclaimer is the individual interpretation of the respective Judge of the opinion of this Court, and the variances in construction are wholly due to their variant interpretations of the opinion of this Court. *As to the validity of the disclaimer and of the claims as limited by the disclaimer, all four judicial opinions are in agreement.*

Your petitioners respectfully submit that the words "results obtained" in the opinion of this Court were intended as identifying means of the process of the patent, to differentiate from any and every other process, prior or subsequent, and that claims 9, 10 and 11, the broadest claims of the patent, are confined by the disclaimer to the subject-matter to which this Court confined the patent, a process such as described and claimed wherein the results obtained are such process-identifying results as are obtained by the use of a suitable oil or equivalent oily liquid in proportions amounting to a fraction of one per cent. on the ore.

If, however, this Court intended to confine the patent to the *use* of a suitable oil in a quantity amounting to a fraction of one per cent. on the ore, then the words "results obtained by the use of" as used by this Court and as repeated exactly in the disclaimer have that meaning, and claims 9, 10 and 11 are so confined. However these claims may be confined, they, like all the rest, take account now only of mineral-froth-forming oil. An oil which, upon agitation, would not produce a mineral-froth, is certainly not described by these claims as limited by disclaimer—is not an oil of these claims.

A further consideration of the disclaimer and a discussion of the law, with citation of authorities, appears in the Supplemental Brief for Petitioners, pp. 47-63.

Costs. The disclaimer was filed during the period of three and one half years between the filing of the original bill of complaint on October 10, 1913, and the commencement of the trial on April 16, 1917, when the parties were awaiting the final determination of the Hyde case. It was filed before the supplemental and amended bill of complaint (filed May 1, 1917), which charged infringement of claims 9, 10 and 11, as limited by disclaimer, subsequent to the issue of the patent, and prior to the filing of the bill of complaint, and continuance of infringement thereof as well as of the other claims in issue up to the time of the filing of the supplemental and amended bill of complaint (Vol I, pp. 40, 41, clause 7). This supplemental and amended bill of complaint raised the only issue of infringement that defendant has contested on appeal, to wit, infringement since January 7, 1917.

The disclaimer statutes provide that

> "no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing it" (U. S. R. S. 4917).

They also provide:

> "But in every such case in which a judgment or decree shall be rendered for the plaintiff, no costs shall be recovered unless the proper disclaimer has been entered at the Patent Office before the commencement of the suit" (U. S. R. S. 4922).

This Court has interpreted these statutes as depriving a plaintiff of costs in the Court of first instance when invalidity was found as to one claim and validity and infringement as to two other claims.

Seymour vs. *McCormick,* 19 How., 96, 107.

The Circuit Courts of Appeal have held that, if after adjudication in the lower court either party prosecutes an appeal, the

costs as to appeals shall not be effected by the disclaimer statutes.

Johnson vs. *Foos Mfg. Co.,* 141 Fed., 73; C. C. A., 6th Circuit, Lurton, Severens and Richards, C. Js.; Hollister, D. J., Opinion by Lurton, C. J.

General Electric Co. vs. *Electric Co.,* 243 Fed., 188; C. C. A., 6th Circuit, Knappen and Denison, C. Js.; Hollister, D. J. Opinion by Denison, C. J.

Kahn vs. *Starrels,* 136 Fed., 597, C. C. A., 3rd Circuit, Acheson, Dallas and Gray, C. Js. Per Curiam.

This Court in *Minerals Separation, Ltd.* vs. *Hyde,* 242 U. S., 261, awarded all costs in this Court and in the District Court to plaintiffs, although it found three claims of the patent to be invalid (Mandate in Hyde case, Vol. I, p. 59). Plaintiffs did not deem it worth while, however, to attempt to enforce their remedy of costs against the defendant in that case.

In the instant case the only issue of infringement contested on appeal to the Circuit Court of Appeals was raised by the supplemental and amended bill. The filing of the disclaimer preceded the filing of this supplemental and amended bill. For this reason petitioners are peculiarly entitled to all costs of appeal should they prevail, and for this reason also it is submitted that costs in the District Court should be awarded petitioners under the supplemental and amended bill for the trial of all issues raised by it and put at issue by the answers to it.

Conclusion.

In conclusion petitioners respectfully submit that they have demonstrated the errors of the Circuit Court of Appeals for the Ninth Circuit; that there is no warrant either in the language of the patent or in the evidence in the instant case or in the language of the decision of this Court in the Hyde case for limiting the claims of the patent which prescribe a fraction of one per cent. of oil or oily liquid relative to ore, to anything less than the plain meaning of the words, but, to the contrary, that the patent in such claims covers at least any and every fraction of one per cent. of oil or oily liquid to ore; that there is no warrant in the patent or in the evidence or in the decision of this Court in the Hyde case for holding that any oil or oily liquid which does not effectuate the process can be considered as the oil or oily liquid of the patent or can be utilized to escape infringement, but, to the contrary it should be held that the determining factor in respect of the oil or oily liquid of the patent is its ability to obtain the results specified by the patent and by each and every claim thereof; and finally that the disclaimer is valid: therefore the decree of the Circuit Court of Appeals should be reversed in so far as it reverses the decree of the District Court, the decree of the District Court should be affirmed *in toto*, and petitioners should be awarded all costs of the appeals, and all costs of the District Court under the supplemental and amended bill filed May 1, 1917.

New York, N. Y., Feb. 26, 1919.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Counsel for Petitioners.

IN THE

Supreme Court of the United States,

OCTOBER TERM—1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

REPLY OF RESPONDENT TO APPLICATION BY PETITIONERS FOR AN ORDER TO RESTRAIN THE SAID RESPONDENT FROM DISPOSING OF ITS ASSETS PENDING ACTION ON THE MANDATE OF THIS COURT.

Petitioners come before this Court in the exercise, not of its original jurisdiction, but of its reviewable jurisdiction, and make the extraordinary request, in the form of a petition

> "for an order restraining the respondent (defendant) Butte & Superior Mining Company from disposing of its assets, by the payment of

> dividends or otherwise, excepting only normal expenditures in the ordinary course of its current business and such extraordinary expenses for betterments, improvements or other purposes as may be approved by the United States District Court of Montana."

In response to this petition, respondent suggests that the following points should be considered:

FIRST: Counsel for the petitioners claim that the extraction of ores and milling the same gives the court jurisdiction to restrain the company from declaring dividends out of the receipts from such ores, and to sustain the proposition cite *Erhardt* v. *Boaro,* 113 U. S. 537. That was a suit in equity ancillary to an action for the possession of a mining claim and was brought to restrain the commission of waste pending the action. The Court properly in that case, as it has done in similar cases, granted the injunction, because the action which it restrained went to the destruction of the substance of the thing then in dispute, namely, the mining claim. By calling attention to the very language used by the petitioners in citing from this case the distinction becomes evident between the instant case and the one from which the extract is quoted.

> "It is now a common practice in cases where irremediable mischief is being done or threatened, *going to the destruction of the substance of the estate,* such as the extracting of ores from a mine * * * to issue an injunction, though the title to the premises be in litigation. The authority of the Court is exercised in such cases, through its preventive writ, to preserve the property from destruction pending legal proceedings *for the determination of the title."* (Italics ours.)

The substance of the action now before the Court is an alleged infringement of a patent; the substance is not the mine or other assets of the respondent.

The petitioners, should they be successful in this litigation, would be entitled to a decree directing an accounting as to the profits made by the respondent from such infringement. They would, accordingly, so far as any recovery in money is procured, become creditors of the corporation.

The assets of a corporation do not constitute a trust fund for its creditors. In the case of *Hollins* v. *Brierfield Coal and Iron Co.*, 150 U. S. 371, it was held that a corporation, as between itself and its creditors, is simply a debtor and does not hold its property in trust or subject to a lien in their favor. In that case the Court said:

> "While it is true language has been frequently used to the effect that the assets of a corporation are a trust fund held by a corporation for the benefit of creditors, this has not been to convey the idea that there is a direct and express trust attached to the property. As said in 2 Pomeroy's Equity Jurisprudence, § 1046, they 'are not in any true and complete sense trusts, and can only be called so by way of analogy or metaphor.'"

In the same case the Court further said:

> "In other words, and that is the idea which underlies all these expressions in reference to 'trust' in connection with the property of a corporation, the corporation is an entity, distinct from its stockholders as from its creditors. Solvent, it holds its property as any individual holds his, free from the touch of a creditor who has acquired no lien; free also

> from the touch of a stockholder who, though equitably interested in, has no legal right to, the property."

Since, as we have shown, a corporation does not hold its property or funds in trust for the benefit of its creditors, but only as a natural person holds his property, it follows that a creditor cannot come into a court of equity and interfere with the management of its affairs unless he can show as his ground for relief sought some fraud or breach of trust against him. The petitioners have failed to set forth any breach of trust on the part of the respondent or of any fraud committed by it, or that it is unable to respond pecuniarily to any damages awarded against it. The case of *Mills* v. *Northern Railway of Buenos Ayres*, 5 Ch. App. 621, especially the language of Lord Hatherley, *L. C.*, is particularly pertinent to the present application:

> "But so far as the case rests on the simple fact of the plaintiffs being creditors of the company, it seems to me hardly capable of argument. Work is done for a limited company; no engagement is taken from them by way of security; no debenture or mortgage is granted by them; but the work is done simply on the credit of the company. The only remedy for a creditor in that case is to obtain his judgment and to take out execution; or it may be that he may have a power, if the case warrants it, of applying to wind up the company. But it is wholly unprecedented for a mere creditor to say, 'Certain transactions are taking place within the company, and dividends are being paid to shareholders which they are not entitled to receive, and therefore I am entitled to come here and examine the company's deed, to see whether or not they are doing what is *ultra vires*, and to interfere in order that, as by a bill *quia timet*, I may keep the assets in a

proper state of security for the payment of my debt whensoever the time arrives for its payment.' The case must have occurred, of course, many years ago, before joint-stock companies were so abundant, but certainly within the last twenty or thirty years the money due to creditors must have been many millions, and the number of creditors must have been many thousands; yet I have never before heard—and I asked in vain for any such precedent—of any attempt on the part of a creditor to file a bill of this description against a company, claiming the interference of this court on the ground that he, having no interest in the company, except the mere fact of being a creditor, is about to be defrauded by reason of their making away with their assets. It would be a fearful authority for this court to assume, for it would be called on to interfere with the concerns of almost every company in the kingdom against which a creditor might suppose that he had demands, which he had not established in a court of justice, but which he was about to proceed to establish. If there is this power in any case, of course it would apply not only to the raising of money by debentures and to paying shareholders, but it would extend to an interference in every possible way with the dealings of the company."

No facts are set forth in the petition showing any irremediable harm to the petitioners. The respondent will be well able to meet any damages that may be awarded against it. It would, indeed, be a novel proceeding for a court to restrain a defendant from disposing of its assets in the fear that a judgment that may or may not be awarded against it might not be satisfied. Counsel for petitioners have not set forth any cases to sustain any such proposition.

SECOND: As a prerequisite to an application for the order prayed for, if it were proper to grant such an order in this case, we submit that petitioners should have affirmatively shown, but have failed to show:

(*a*) That respondent is insolvent or is otherwise unable to meet any judgment which may be assessed against it after an accounting:

(*b*) That respondent is dissipating or liquidating its assets to an unwarranted extent, and conducting its business in an unwarranted or extraordinary manner, such as will endanger or seriously impair the value of its tangible assets:

(*c*) That, unless enjoined, respondent's assets will be dissipated to such an extent as will render it unable to meet any judgment which may be had, or award made to petitioner after an accounting.

THIRD: The alleged profits of $18,000,000 (see petition, p. 6) are all the profits which respondent-defendant has made in the conduct of both its mining and milling operations (including concentration) for the twelve years it has been engaged in the business of mining and milling ores.

The statement in the petition regarding profits due to the alleged infringement (pp. 6 and 7), are all based on mere speculation and conjecture, without any supporting proof.

It should be understood that respondent is engaged not only in the business of concentrating ores, but is, at the same time, engaged in the business of mining and milling of such ores before con-

centration—that is, taking the ores out of the ground and grinding them so as to render them fit for concentration by non-infringing as well as alleged infringing processes. Mining and milling operations are separate and distinct operations, and are frequently conducted by separate and distinct companies. The ore when taken out of the ground is more valuable than when in the ground, and a profit accrues from this operation. The ore after preliminary milling is more valuable than when taken out of the ground and a profit also accrues from this operation. The preliminary wet concentration of the ground ore, on riffle tables and the like, makes the resultant product more valuable than the milled ore, and a profit accrues from this operation. The alleged infringing operation in which the petitioners are alone interested, is the final concentration of the concentrates or tailings from the riffle-tables, and the profit which accrues from this last operation is the only thing with which the petitioners are concerned.

We respectfully submit, therefore, that the petition lacks any showing as to the profit to which petitioners are entitled by reason of the last-named operation. This question has not been in issue in any proceedings heretofore had.

FOURTH: It will be remembered that this Court in the *Hyde* case (242 U. S. 261), said that the

> "final step was not a long one, and the patent must be confined to the results obtained by *the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' amounting to a 'fraction of one per cent. on the ore'*" (p. 271). (Italics ours.)

It will also be remembered that this Court decreed that the patent was valid and infringed as to certain claims, but was "invalid as to Claims 9, and 10, and 11" (p. 271) because of the fact that such claims were not limited to the "critical proportions often described in the testimony", etc. Further, as shown by the record, such claims 9, 10 and 11, which were drawn to cover the use of oil in small quantities, have been amended so as to limit them to the critical proportions, by way of an alleged statutory disclaimer.

Immediately after the decision of this Court in the *Hyde* case (242 U. S. 261) respondent changed its operations to accord with such decision, that is, since that date it has always used oils in quantities above one-half of one per cent., and, at times, above one per cent. This was what the Court of Appeals for the Ninth Circuit found did not constitute infringement, and it is for the purpose of securing the profits due to these non-infringing operations that petitioner is now asking for a restraining order.

In no place has petitioner shown affirmatively from the record, or otherwise, what was the amount of profits due to operations such as were held to be infringements by this Court in the *Hyde* case,—that is, profits due to operations prior to January 7, 1917.

Stated otherwise, the petitioners are asking for a restraining order not only to protect them as to such profits as may have been made by respondent during the period of the operations which have been held to be infringements by this Court, but for a restraining order covering the operations of respondent for the last two years, which have

been held by the Circuit Court of Appeals for the Ninth Circuit to be non-infringing operations.

FIFTH: Orders of the kind asked for by petitioners are not granted to indemnify a party complainant for past operations, but only to protect it from future infringing operations.

SIXTH: As we have already stated herein, petitioners are asking for the entire profits of respondent, naming the enormous figure of $18,000,000. The order which was vacated by his Honor Judge Bourquin in the District Court, compelled respondent-defendant to deposit a good and sufficient bond in the court and which bond in the amount of $75,000 was deposited in the court, and also to

> "therewith deposit in this Court the actual receipts of all its operations less actual expenses in conducting its business aforesaid."

These actual receipts of all its operations were paid into court for a period approximating nine months. The order was issued *nunc pro tunc* as of September 17, 1917. Said order was vacated on the 27th day of June, 1918, ten months thereafter. Reports were made for this period, and actual receipts were paid in on account thereof, according to petitioner's statement (p. 6 of the petition), in an amount approximating $100,000. As a matter of fact, respondent-defendant, as per affidavit of its Assistant Manager, Mr. Bocking (hereto attached in the Appendix and marked "Exhibit D"), prior to June 27, 1918, the date of the order vacating the original order, had paid into court approximately $320,000 instead of the $100,000 as stated by petitioner.

This amount, as well as the bond for $75,000, is still deposited in court.

Mr. Bocking states in his affidavit that the respondent has neither declared nor paid any dividends since September, 1917.

SEVENTH: All the petitioners, except the Minerals Separation North American Corporation, are foreigners (see original and amended bill of complaint, Transcript, p. 2 and p. 38) and all the stock of Minerals Separation North American Corporation was issued to, and presumably is still owned by, one of the foreign corporations (Transcript, Vol. III, p. 1425, QQ. 9 to 18). We submit that if any restraining order be issued, it should be conditioned upon the petitioners giving a good and sufficient bond in an amount which will protect this respondent should it be ultimately determined that such restraining order was not properly granted.

Conclusion.

It is respectfully submitted that the application of the petitioner should be denied.

THOMAS F. SHERIDAN,
J. EDGAR BULL,
FREDERICK P. FISH,
THOMAS L. CHADBOURNE,
KURNAL R. BABBITT,
Counsel for Respondent.

"Exhibit D."

STATE OF NEW YORK,
County of New York, } ss.:

CHARLES BOCKING, being duly sworn, deposes and says:

I am of lawful age, and reside at Butte, Montana. I have been and am still employed by the Butte & Superior Mining Company, successor in name and title to the Butte & Superior Copper Company, Limited. I have been associated with said Company for over six years, first as its Cashier, and, for the last two years, have been Assistant Manager of the corporation, with principal offices at Butte, Montana.

By reason of my official connections with said Company, I am and have been thoroughly familiar with the financial position and physical condition of said corporation. Said Company, according to my knowledge by reason of my official position, has not declared or paid any dividends since September, 1917 and has not at the present time any idea of declaring any dividends so far as I am informed and believe, and has as quick assets, cash in bank, Liberty Bonds, moneys on deposit in the District Court of Montana in this case, inventories, investments, metals in transit, marketable investments at their market values, an amount approximating $4,500,000, as against liabilities of approximately $300,000. This does not take into consideration the value of the mine or the ores in the mine or the plant or equipment.

I am also familiar with the operations of the mine, and I am certain that the mine values have not been liquidated or impaired up to date, so far

as it can be determined by engineering investigations and reports on file with the Company. The resources of the mine have not been seriously depleted, and a conservative estimate places the duration of its life at thirteen years at the average rate of depletition since 1913. The Company is solvent and entirely able to meet any judgment that may be made against it or award given to Petitioners by reason of any accounting ordered in the present case.

Said Butte & Superior Mining Company has at present on deposit with the District Court of Montana as a joint security in this and in the Elm Orlu case referred to in the petition for a restraining order approximately $571,200, of which approximately $250,000 is on deposit as security for the Elm Orlu Company and $321,200 for the Plaintiffs in this suit.

Subscribed and sworn to before me this 18th day of December, 1918. } CHARLES BOCKING

A. H. MACQUILLEN

[SEAL] Notary Public, New York County Clerk's No. 401

New York County Register's No. 9349

Commission expires March 30, 1919

Service of a copy of the foregoing brief and exhibit is acknowledged this day of December, 1918.

Office Supreme Court, U. S.
FILED
DEC 21 1918
JAMES D. MAHER,
CLERK.

IN THE

Supreme Court of the United States

October Term, 1918.
No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

APPLICATION FOR AN ORDER TO RESTRAIN THE RESPONDENT, BUTTE & SUPERIOR MINING COMPANY, FROM DISPOSING OF ITS ASSETS PENDING ACTION ON THE MANDATE OF THIS COURT; AND EXHIBITS AND BRIEF THEREON.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
ODELL W. MCCONNELL,
Counsel for Petitioners.

IN THE

Supreme Court of the United States

October Term—1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
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ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS, NINTH CIRCUIT.

APPLICATION FOR AN ORDER TO RESTRAIN THE RESPONDENT, BUTTE & SUPERIOR MINING COMPANY, FROM DISPOSING OF ITS ASSETS PENDING ACTION ON THE MANDATE OF THIS COURT.

Now come Minerals Separation, Limited, Minerals Separation American Syndicate, Limited, and Minerals Separation North American Corpor-

ation, petitioners, and make this their application for an order restraining the respondent (defendant) Butte & Superior Mining Company from disposing of its assets, by the payment of dividends or otherwise, excepting only normal expenditures in the ordinary course of its current business and such extraordinary expenses for betterments, improvements or other purposes as may be approved by the United States District Court of Montana; and as grounds for such action respectfully show:

The order hereby applied for if and when granted, will, in part, revive an order entered by consent of parties in the United States District Court of Montana on October 3, 1917, a certified copy of which is annexed hereto and marked Exhibit A.

That order remained in force until June 27, 1918, when, on motion of the defendant below, it was vacated and annulled by an order a certified copy of which is hereto annexed and marked Exhibit B. This latter order was granted at the settlement of the decree in the District Court pursuant to the mandate of the Circuit Court of Appeals of the Ninth Circuit which was issued by said Circuit Court of Appeals upon the decree a review of which has been directed by this Court on certiorari. Judge George M. Bourquin, District Judge, held that he had no power to further continue in force an order based upon a stay of injunction since the defendant did not move to stay the injunction in the modified form decreed by the Circuit Court of Appeals. This modified injunction only restrained the defendant from using oil in a total quantity of one-half of one per cent. or less on the ore, and did not restrain it from using

oil in any total quantity which was any fraction of one per cent. greater than one-half of one per cent., regardless in all cases of the character and operative effect of the oil or oil mixture used. This modified injunction permitted the defendant to continue its use of mineral-froth-forming oil in the proportion of about one-tenth of one per cent. in admixture with such an amount of an oil which was not mineral-froth-forming, that the total quantity of the mixture was greater than one-half of one per cent. on the ore.

The consent order of October 3, 1917, had vacated and replaced an order entered in open court by Judge Bourquin on September 17, 1917, whereby defendant's motion to stay an injunction against further infringement of the patent in suit was granted conditioned upon the filing by defendant of a stay bond in the sum of $2,500,000, and the monthly depositing in court of the actual receipts of defendant's operations, less actual expenses, or bonds in the amounts thereof. A certified copy of this order of September 17, 1917, is hereto annexed and marked Exhibit C.

This bond of $2,500,000, and the monthly deposit into court of the profits of the defendant from all of its operations, of which those in issue herein are a part, were directed by Judge Bourquin as presenting a practicable means, though not adequate, towards assuring payment to the plaintiffs of the final judgment to be awarded herein. Judge Bourquin at the hearing said that a mining business was essentially a business of liquidating assets, and that undoubtedly a very large money recovery would follow the accounting in this case, and that the bond required was not considered by him as

commensurate with the probable recovery but was as large as defendant could reasonably be expected to procure.

After the making of this order, defendant's counsel represented to plaintiffs' counsel that it was impossible for it to obtain a bond for so large an amount as $2,500,000, and suggested submission by the defendant to an injunction against disposal of assets in lieu of the filing of such a bond; and the negotiations between the parties finally resulted in the consent order of October 3, 1917.

The present suit was commenced October 10, 1913, and was accompanied by an application for an injunction *pendente lite* restraining infringement of the patent in suit in view of the decree of the same District Court in the suit against James M. Hyde. That decree (of the District Court in the Hyde case) was in substance finally affirmed by this Court in Minerals Separation, Limited and Minerals Separation American Syndicate, Limited, *vs.* Hyde, 242 U. S., 261, but at the time of the application for preliminary injunction in the instant case, November, 1913, an appeal from the decree in the Hyde case was pending in the Circuit Court of Appeals for the Ninth Circuit, and Judge Bourquin for that reason deemed it inadvisable to grant the preliminary injunction. In his opinion, filed November 14, 1913, he said:

> "At the present time the adjudication of the patent's validity in the Hyde suit is but recent. An appeal therein is now pending. It may succeed. The Appeal Court may arrive at a conclusion contrary to this Court, and adjudge the patent invalid."

Judge Bourquin therefore ordered the filing by the defendant of a bond in the sum of $75,000, and the filing of verified monthly reports setting out the operations of its flotation plant, this being the part of its plant wherein discarded tailings of all other operations are treated by the process in suit. Such bond was filed, and the monthly reports of defendant's flotation operation were also filed, commencing with operations of November 1, 1913, and continuing through the years 1913, 1914, 1915, 1916, 1917 and 1918, until filing was discontinued pursuant to the aforesaid order of June 27, 1918 (Exhibit B), which vacated the aforesaid consent of October 3, 1917 (Exhibit A). These reports insofar as they cover the period of admitted and adjudged infringement herein (operations employing one-half of one per cent. or less of oil) to wit, the operations from November 1, 1913, to and including December 31, 1916, show that in these admitted and adjudged infringing operations the total value of the concentrates recovered was $18,970,875.63, the total cost of the operation of the flotation plant was $1,136,452.42, and that therefore the profit of the infringing operations was $17,834,423.21, or about eighteen million dollars.

The admitted and adjudged infringing operations of the defendant commenced in August, 1911, and therefore the profits made by the defendant from August, 1911, to November 1, 1913, a period of two years and two months, are not included in this amount.

On January 7, 1917, the defendant modified its procedure to that which the District Court has decreed to be an infringement of the patent in suit and the Circuit Court of Appeals of the Ninth Circuit has decreed not to be an infringement of the

patent in suit, to wit, the employment of more than one-half of one per cent. of a special oil mixture. The question therefore as to whether or not these operations, commencing in January, 1917, are also infringements of the patent in suit, is the specific issue presented to this court, and therefore such profits also are not included in the above statement.

The defendant has distributed to its stockholders in dividends the total amount of $16,940,257.88 as stated in its annual report for the year 1917, dated March 30, 1918. The payment of dividends commenced in June, 1914, some eight months after the first order was made in November, 1913, directing the filing of monthly statement of infringing operations, and was continued until stayed by the consent order of October 3, 1917, the last dividend having been declared just prior to the said order of October 3, 1917. Thus the defendant, during the pendency of these proceedings, has dissipated, by distribution to its stockholders, about seventeen million dollars of its profits, and such dissipation continued until it was stopped by said consent order of October 3, 1917.

As against the profits made by the defendant in operations unquestionably infringing the patent in suit, amounting to more than eighteen million dollars ($18,000,000), defendant has deposited with the Clerk of the District Court by way of security for petitioners, a surety bond for $75,000 under the order of November, 1913 (denying preliminary injunction), and about one hundred thousand dollars in Liberty Bonds under the aforesaid consent order of October 3, 1917, a total security of less than one per cent. of said profits.

A mining business is essentially a liquidating business. Its assets are the ores in its mine, and its business is to dig these ores out of its mine to separate the valuable minerals from the dross and to sell these valuable minerals. Its business therefore is to liquidate its assets, or change them into money, and when this money is distributed to its stockholders, its assets are dissipated. There is nothing left for its creditors except its now useless plant and a hole in the ground.

Although no accounting has yet been had in this suit, it is the admitted fact by the defendant's own reports that its profits over a part of the period of undoubted admitted infringement, approximate eighteen millions of dollars, and it is petitioners' contention and confident judgment that they will show that such profits are substantially wholly attributable to the use of petitioners' patented invention.

As shown above, respondent has by way of dividends already distributed to its stockholders approximately seventeen millions of dollars, and it is now, by reason of the vacation and annulment of the consent order of October 3, 1917, free to dispose of and distribute to its stockholders the whole of its assets which have been turned into money by its operations, so that the petitioners are in peril with respect to the recovery of any sums which may be awarded to them by the final judgment to be entered in the instant case.

The title of respondent Butte & Superior Mining Company to a substantial portion of its mine is already in issue in the case of Butte & Superior Copper Company, Ltd., appellant (defendant), vs. Clark-Montana Realty Company and Elm Orlu

Mining Company, appellees (plaintiffs), No. 598 on the current docket of this court. In that case, both decisions below were adverse to Butte & Superior Mining Company. This is additional reason for an order from this Court to prevent the dissipation of respondent's assets pending the termination of the present suit.

Wherefore your petitioners pray for an order restraining the respondent (defendant) Butte & Superior Mining Company from disposing of its assets, by the payment of dividends or otherwise, excepting only normal expenditures in the ordinary course of its current business and such extraordinary expenses for betterments, improvements or other purposes as may be approved by the United States District Court of Montana, pending action on the mandate of this Court; or for such other and further relief to prevent dissipation of assets as to this Court shall seem meet.

MINERALS SEPARATION, LIMITED,
MINERALS SEPARATION
AMERICAN SYNDICATE, LIMITED,
MINERALS SEPARATION
NORTH AMERICAN CORPORATION,
By Henry D. Williams,
Counsel.

State of New York,
County of New York, } ss.:

Henry D. Williams, being first duly sworn, deposes and says that he is general counsel of the petitioners herein and is familiar with all proceedings herein and that the facts stated in the foregoing application are true and that the additional matters therein stated as upon information and belief or by way of argument and inducement are true as he verily believes.

HENRY D. WILLIAMS.

Subscribed and sworn to before me this
9th day of December, 1918.

FRANK L. REQUA,
Notary Public,
New York County.

EXHIBIT A.

DISTRICT COURT OF THE UNITED STATES,

DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, et al., Plaintiffs, against BUTTE & SUPERIOR MINING COMPANY, Defendant.	In Equity.

With the consent of counsel for both parties, the order relating to the suspension of the injunction entered herein September 17th, 1917, is hereby vacated and the following order is substituted therefor:

IT IS ORDERED that the injunction granted is stayed pending the final termination of this suit and that the defendant, until the final termination of the suit and payment of judgment, is enjoined and restrained from disposing of its assets, excepting normal expenditure in the ordinary course of its current business; and in the event that the defendant desires to incur extraordinary expenses for betterments, improvements, or for other purposes, an application may be made to this Court for permission so to do.

AND IT IS FURTHER ORDERED that the defendant shall continue the monthly reports of its flotation operations as heretofore ordered, and in addition file a like monthly statement of all its other operations, and therewith deposit in this Court the actual receipts of all its operations, less actual expenses in conducting its business aforesaid, or a good and sufficient bond in the amount thereof that they will be forthcoming for application upon any profits and damages finally awarded plaintiffs herein.

This order shall take effect, *nunc pro tunc,* as of September 17th, 1917.

AND IT IS FURTHER ORDERED that either party may apply to this Court upon twenty days' notice to the other party for any amendment, supplement or modification of this order.

GEO. M. BOURQUIN,
Judge.

Filed and entered
October 3, 1917.

GEO. W. SPROULE,
Clerk.

Approved:
Lindley M. Garrison.
Henry D. Williams.
J.Edgar Bull.
K. R. Babbitt.
J. Bruce Kremer.
L. P. Sanders.
Alf. C. Kremer.

United States of America,
District of Montana, } ss.:

I, Geo. W. Sproule, Clerk of the United States District Court for the District of Montana, do hereby certify that the foregoing is a full, true, correct and compared copy of the original order filed and entered, October 3, 1917, in the case of Minerals Separation, Limited, et al., vs. Butte & Superior Mining Company, being Case No. 8 in said Court, appearing on file and of record in my office as such Clerk.

Witness my hand and the seal of said Court at Butte, Montana, this 6th day of October, A. D. 1917.

GEO. W. SPROULE,
(Seal) Clerk.

Endorsed: Title of court and cause. Certified copy order staying injunction. Filed Oct. 11, 1917. Geo. W. Sproule, Clerk, by H. H. Walker, Deputy.

United States of America,
District of Montana, } ss.:

I, C. R. Garlow, Clerk of the United States District Court for the District of Montana, do hereby certify that the foregoing is a full, true, correct and compared copy of the original Certified Copy of the Order filed and entered October 3, 1917, served on the defendant, Butte & Superior Mining

Co., by the United States Marshal, in the case of Minerals Separation, Limited, et al. vs. Butte & Superior Mining Company, being case No. 8 in said Court, appearing on file and record in my office as such Clerk.

Witness my hand and the seal of said Court, at Butte, Montana, this 8th day of August, 1918.

C. R. GARLOW, Clerk,
By L. R. Polglase, Deputy.

Form No. 282.

RETURN ON SERVICE OF WRIT.

United States of America,
District of Montana, } ss.:

I hereby certify and return that I served the annexed Writ (staying injunction) on the therein-named Butte & Superior Mining Co. by handing to and leaving a true and correct copy thereof with Chas. Bocking, Assistant Manager, personally at Butte, Silver Bow County, in said District, on the 11th day of October, A. D. 1917.

JOS. L. ASBRIDGE,
U. S. Marshal.

By P. J. Moore,
Deputy.

EXHIBIT B.

UNITED STATES DISTRICT COURT,

DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION, Plaintiffs, vs. BUTTE & SUPERIOR MINING COMPANY, formerly Butte and Superior Copper Company, Limited, Defendant.	In Equity.

Herein the motion to modify the order of October 3rd, having been submitted to the Court and argued by the counsel, it is by the Court ordered that the said order of October 3rd, 1917, be, and hereby is vacated and annulled.

BOURQUIN,
Judge.

See 237, Fed., 401.

Endorsed: Title of Court and cause. Order vacating order of October 3, 1917. Filed June 27, 1918. C. R. Garlow, Clerk.

United States of America,
District of Montana, } ss.:

I, C. R. Garlow, Clerk of the United States District Court, for the District of Montana, do hereby certify the above and foregoing to be a full, true, correct and compared copy of the original order of the Court of June 27, 1918, in Case No. 8, Minerals Separation, Ltd., et al. vs. Butte & Superior Mining Co., on file and of record in my office as such Clerk.

Witness my hand and the seal of said Court at Butte, Montana, this 20th day of November, A. D. 1918.

C. R. GARLOW,
Clerk.

(Seal)

EXHIBIT C.

IN THE DISTRICT COURT OF THE UNITED STATES,

DISTRICT OF MONTANA.

MINERALS SEPARATION LTD., et al. vs. BUTTE & SUPERIOR MINING COMPANY.	No. 8.

This cause came on regularly for hearing at this time upon plaintiffs' motion for the entry of an interlocutory decree pursuant to the decision of the court herein, and the defendant's objections to the entry of such decree as presented Henry D. Williams, Esq., Lindley M. Garrison, Esq., Wm. H. Kenyon, Esq., and O. W. McConnell, Esq., appearing for plaintiffs, and J. Bruce Kremer, Esq., appearing for defendant. Thereupon the matter was duly argued and submitted to the court. Thereupon defendant moved the court for an order staying the issuance of injunction pending appeal herein, and the plaintiffs having no objection to a stay of injunction, provided defendant shall furnish good and sufficient bond and upon terms, the matter was duly argued and submitted to the court. Thereupon the court, after due consideration, signed and ordered filed and entered its interlocutory decree herein and the following written order, to wit:

"Herein, it is ordered that the injunction granted is stayed for 30 days and pending appeal from the interlocutory decree and until the further order of the court, provided defendant within said 30 days file herein good and sufficient stay bond conditional as usual, in the sum of $2,500,000.00, continue the monthly reports heretofore ordered, and therewith deposit in this court the actual receipts of its operations less actual expenses in producing the same, or a good and sufficient bond in the amount thereof that they will be forthcoming for application upon any profits and damages finally awarded plaintiffs herein."

Thereupon it was stipulated and agreed by respective counsel in open court that the amount of bond on appeal herein, when same shall be applied for, may be fixed by the court at the sum of $10,000.00.

Entered in open court September 17, 1917.

GEO. W. SPROULE,
Clerk.

Attest a true copy
GEO. W. SPROULE, Clerk.
By C. R. Garlow, Deputy.
(Seal)

IN THE

SUPREME COURT OF THE UNITED STATES,

OCTOBER TERM—1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS, NINTH CIRCUIT.

BRIEF IN SUPPORT OF APPLICATION FOR ORDER RESTRAINING RESPONDENT FROM DISPOSING OF ITS ASSETS PENDING ACTION ON THE MANDATE OF THIS COURT.

The purpose of the present application is to obtain a partial restoration of the *status quo* which was destroyed by the decree of the Circuit Court of Appeals of the Ninth Circuit a review of which has been directed on certiorari by this Court. That partial restoration will merely prevent the dissipa-

tion of the assets of the respondent (defendant) pending the appeal. The respondent's business is that of liquidation of its assets, and while no interference is contemplated with the orderly carrying on of that business up to the point of dissipation of its assets, it is asked that pending action in the District Court on the mandate of this Court, the money realized by the respondent from mining its ore and separating and selling the valuable mineral therein be retained by the respondent for the purpose of creating a fund to pay the judgment which may reasonably be expected based on enormous profits which the defendant has admittedly acquired from its infringing acts.

This Court has jurisdiction in the matter, under Section 262 of the Judicial Code, which substantially reenacted U. S. R. S., Section 716. We quote from Section 262 of the Judicial Code as follows:

> "The Supreme Court, the Circuit Courts of Appeal and the District Courts shall have power to issue all writs not specifically provided for by statute, which may be necessary for the exercise of their respective jurisdictions, and agreeable to the usages and principles of law."

This Court has heretofore acted in analogous cases, and particular attention is called to the case of Omaha & Council Bluffs Street Railway Company vs. Interstate Commerce Commission, 222 U. S., 582. Here this Court said:

> "Upon full consideration of the facts bearing upon the propriety of the appellant's motion for an order to maintain the *status quo* pend-

> ing this appeal, it is ordered that the enforcement of the order of the Interstate Commerce Commission * * * be, and it is, suspended and *enjoined* during the pendency of this appeal" (Italics ours).

See also cases cited therein.

In that case it was necessary to provide a bond of indemnity against damages suffered by reason of the restraining order, but in the present case, since the order merely restrains the dissipation of assets, it is not conceivable that any injury can result to the respondent from such restraint. It will be noted that the restraining order requested makes proper provision for everything that shall be necessary in the carrying on of respondent's business, in this respect following exactly the restraining order in the lower Court which was vacated as a result of the decree now under review.

This Court has heretofore acted to restrain the carrying on of mining operations pending controversies as to title, recognizing the well known fact that a mining business is a business of liquidation of assets. For example, Erhardt vs. Boaro, et al., 113 U. S., 537, was a suit in equity ancillary to an action at law for the possession of a mining claim. The bill prayed for an injunction restraining mining on the claim or extracting ore or removing ore already extracted until the final determination of the action at law. The lower Court had granted such a preliminary injunction, but after the trial of the action at law, resulting in a judgment adverse to the plaintiff in the suit in equity, it dissolved the injunction and dismissed the bill. On writ of error to this Court a new trial was ordered in the action at law and on accompanying appeal

the decree dismissing the bill in equity was reversed with directions to restore the injunction until the final determination of the action of law. This Court said:

> "It is now a common practice in cases where irremediable mischief is being done or threatened, going to the destruction of the substance of the estate, *such as the extracting of ores from a mine* * * * to issue an injunction, though the title to the premises be in litigation. The authority of the Court is exercised in such cases, through its preventive writ, to preserve the property from destruction pending legal proceedings for the determination of the title" (italics ours).

In the instant case no restraint is asked as to the operation of respondent's mine, but merely of the dissipation of assets pending action on the mandate of this Court.

Respectfully submitted,

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL.
Counsel for Petitioners.

IN THE SUPREME COURT OF THE UNITED STATES,

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION, Petitioners, vs. BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.	October Term 1918. No. 599

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS, NINTH CIRCUIT.

To

J. EDGAR BULL, Esq.,
New York City, N. Y.,
Counsel for Butte &
Superior Mining Company.

PLEASE TAKE NOTICE that on Monday, December 23rd, 1918, at 12 o'clock noon, or as soon thereafter as counsel can be heard, the foregoing application, and exhibits and brief in support of said application, will be submitted to the Supreme

Court of the United States for its consideration and action.

Dated, New York, N. Y., December 9, 1918.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL.
Counsel for Petitioners.

Service of a copy of the foregoing application, exhibits and brief in support of said application is acknowledged this 9th day of December, 1918.

J. Edgar Bull

FILED
DEC 21 1918
JAMES D. MAHER,
CLERK.

IN THE

Supreme Court of the United States

October Term, 1918.
No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

MOTION TO ADVANCE THE CASE.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
ODELL W. MCCONNELL,
Counsel for Petitioners.

IN THE

Supreme Court of the United States

October Term 1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

MOTION TO ADVANCE THE CASE.

Now come Minerals Separation, Limited, Minerals Separation American Syndicate, Limited, and Minerals Separation North American Corporation, Petitioners above named and move this honorable Court to advance the above case and assign same for argument at an early day, and as ground for such motion respectfully show:

In this case certiorari has been granted to review the decree of the Circuit Court of Appeals for the Ninth Circuit wherein a limited construction was put upon United States Letters Patent No. 835,120 to Sulman, Picard and Ballot of November 6, 1906, for a process of ore concentration, in contravention, as petitioners believe and charge, of the decision of this Court in the case of Minerals Separation, Limited and Minerals Separation American Syndicate, Limited vs. James M. Hdye, 242 U. S., 261, wherein the validity of said letters patent was adjudicated.

As appears in the Petition for Writ of Certiorari (page 2) this suit not only involves a patent which has been heretofore passed upon by this Court, but the respondent here, Butte & Superior Mining Company, carried on in its mill, by its employees, with its own ore and for its own profit, the acts formerly adjudicated by this Court to be infringements, the defendant Hyde in the former case having merely initiated and for a time superintended those acts. The respondent here Butte & Superior Mining Company has but continued the infringement initiated by the respondent Hyde in the former case.

After announcement of the decision of this Court in the Hyde case, respondent varied its procedure and process in an immaterial respect, as petitioners believe and charge. In the instant case the District Court, on the basis of the decision of this Court in the Hyde case, held the variation immaterial and that the infringement had continued. The Circuit Court of Appeals, as appears in the Petition for Writ of Certiorari (page 2), reversed this holding as to continuing infringement, on the sole basis of its different interpretation of the decision of this

Court in the Hyde case, and thereby, as petitioners believe and charge, that decision of this Court holding the invention patentable, was avoided and rendered practically nugatory and valueless, and a way was opened for the use and enjoyment of the invention without liability to the owners of the patent; and respondent and other large affiliated companies, are in that way using and enjoying the invention on an enormous aggregate tonnage.

As to parties, two of the petitioners herein, Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, were the petitioners and plaintiffs in the case formerly adjudicated by this Court. The respondent here, Butte & Superior Mining Company, as was admitted in the Hyde case and as abundantly appears in the present case, paid all the expenses of the defense of the former suit.

As was alleged in the Petition for Writ of Certiorari (page 16) and not denied, the present case is closely analogous to one in which a court of subordinate jurisdiction has not properly carried out the mandate of a superior court in the same case. The respondent here employed the respondent Hyde of the former suit to direct for it the act of infringement adjudicated in the former suit, and participated in that act of infringement, and is sued here for that participation as well as for its continuance of the infringement by identical acts through a term of years and by later further acts as to the infringing character of which the District Court of Montana and the United States Circuit Court of Appeals of the Ninth Circuit are in disagreement, as aforesaid.

It is submitted, therefore, that the present case comes within the principle of paragraph 4 of Rule 26 of this Court in that the patent in suit has been once adjudicated by this Court, the parties in interest are substantially the same (even though the respondent here be not technically in privity with the respondent in the former suit) and the subject-matter is the same. The point at issue is whether the decision of this Court in the Hyde case, properly interpreted, permits such a limitation to be given to the patent as to enable the respondent, Butte & Superior Mining Company, to obtain the benefit of the patented invention and escape infringement.

It is also submitted that the case is one having such special and peculiar circumstances as should cause it to be advanced under paragraph 7 of Rule 26. This Court has defined the invention and sustained the patent. The Courts below in the instant case are not in agreement as to the proper interpretation to be put upon your decision. The patent here involved affects primarily the mining community at large, and secondarily the general public in a very direct manner. Many producers of metal are licensed under the patent, and many other producers of metal are, as petitioners claim, using the invention in defiance of the patent. Many others, because of the uncertain condition of the law, are falling far short of their possible production because they hesitate to use the invention. Unless this case is advanced and a speedy decision is reached this condition of uncertainty will continue for a long period and the effect thereby produced will be detrimental and injurious to the general community, the mining community, the petitioners and the respondent herein and will hamper

the administration of justice. During the long period of delay of decision in the instant case the petitioners will be obliged, owing to the fact that the patent has only a limited life, to bring suits against scores of infringers, and in the uncertain state of the law such suits will undoubtedly result in various differing and perhaps opposing decisions in the lower courts which may necessitate numerous separate applications to this Court and to be made uniform by this Court in accordance with its final authoritative decision in the instant case. All of this can be avoided, production can be stimulated, the general public will be benefited and the mining community will have this important question set at rest if this Court, in view of the special and peculiar circumstances of the case, will advance the same and thereby reach a speedy conclusion.

Petitioners' counsel are authorized to state that counsel for the respondent concur in the advancement of the case, provided the case be not assigned for hearing for a day earlier than the first Monday of April, 1919.

Respectfully submitted,

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Counsel for Petitioners.

IN THE

SUPREME COURT OF THE UNITED STATES,

OCTOBER TERM, 1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

vs.

BUTTE & SUPERIOR MINING COMPANY, designated as Butte & Superior Copper Company, Limited.

ON CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

To J. Edgar Bull, Esq., New York City, N. Y., Counsel for Butte & Superior Mining Company:

PLEASE TAKE NOTICE that on Monday, December 23rd, 1918, at 12 o'clock noon, or as soon thereafter as counsel can be heard, the foregoing motion to advance this case for argument will be

submitted to the Supreme Court of the United States for its consideration and action.

Dated, New York, N. Y., December 9, 1918.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Counsel for Petitioners.

Service of a copy of the foregoing motion to advance is acknowledged this 9th day of December, 1918.

J. Edgar Bull

Office Supreme Court, U. S.
FILED
OCT 4 1918
JAMES D. MAHER,
CLERK.

Supreme Court of the United States.

OCTOBER TERM, 1918.

No. 599.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,

Respondent.

On Petition for Writ of Certiorari.

BRIEF FOR RESPONDENT.

THOMAS F. SHERIDAN,
FREDERICK P. FISH,
J. EDGAR BULL,
J. BRUCE KREMER,
KURNAL R. BABBITT,
Of Counsel for Respondent.

C. G. BURGOYNE PRINTING BUSINESS, 72-78 Spring St., New York.

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SUPREME COURT OF THE UNITED STATES.

MINERALS SEPARATION, LTD., MINERALS SEPARATION AMERICAN SYNDICATE, LTD., and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

AGAINST

BUTTE & SUPERIOR MINING COMPANY,

Respondent.

BRIEF FOR RESPONDENT.

I. If the writ prayed for be issued, it will bring up for determination by this Court only a single question, to wit: the question whether the patent in suit covers the use of oil in quantities between one-half of one per cent. and one per cent. on the ore (see *infra*, pp. 2 to 11).

II. The petitioners allege that the writ, if issued, will bring up for determination another question, to wit: the question whether oils inert in the process are to be taken into account in determining the question of infringement; but in fact no such question is presented by the facts of the case (see *infra*, pp. 11 to 24).

III. There is no conflict of decisions (see *infra*, pp. 24 and 25).

IV. The case does not present any novel question of law.

V. The case does not involve subject-matter which affects the interest of the nation or of the public generally.

I.

The only question involved is whether the patent in suit covers the use of oil in quantities between one-half of one per cent. and one per cent. on the ore.

(a)

That the patent in suit does not, as amended by disclaimer, cover the use of oil in quantities above one per cent. on the ore, has already been squarely decided by this Court. The patent as it came before this Court in the Hyde case contained not only claims limited, in terms, to "a fraction of one per cent." of oil (1, 2, 3 and 12 in issue), but also claims broad enough to cover the use of "a small quantity" of oil (9, 10 and 11 in issue). While this Court sustained the fraction-of-one-per-cent. claims, it condemned the small-quantity claims as being too broad. It said (242 U. S., 261):

> "The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is '*critical*' and *minute* as compared with the amount used in prior processes, '*amounting to a fraction of one per cent. on the ore*' (p. 265).
>
> * * * * * *
>
> "The experimenters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid was used (p. 267).
>
> * * * * * * *
>
> "While we thus find in favor of the validity of the patent, *we cannot agree with the District Court in regarding it valid as to all of the claims in suit.* As we have pointed out in this opinion, there were many investi-

gators at work in this field to which the process in suit relates when the patentees came into it and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,' yet the investigations preceding were so informing that this *final step was not a long one, and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore,'* and therefore the decree of this court will be that the patent is valid as to claims Nos. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is *invalid as to claims* 9, 10 *and* 11 " (p. 271).

Comparing the group of claims which was sustained—to-wit, claims 1, 2, 3 and 12—with the group of claims which was condemned—to-wit, claims 9, 10 and 11—it will be seen that all the claims of both groups were limited in terms to the production of a " froth " by " agitation," and to the separation of the " froth " from the material ; but that the claims which were sustained were limited in terms to the use of oil in " *a fraction of one per cent.*" *(what fraction* of one per cent was not specified), while the claims which were condemned were broad enough to cover the use of " *a small quantity* " of oil. The only difference between the claims which were sustained and those which were condemned is, therefore, that the former were, while the latter were not, in terms limited to the use of less than one per cent. of oil on the ore.

In view of this decision, the plaintiffs filed a disclaimer which they allege limits the small-quantity claims (9, 10 and 11) so to conform with the above decision.

That the patent in suit does not cover the use of oil in quantities of one per cent. or more has, therefore, been squarely decided by this Court.

(b)

The Court of Appeals for the Ninth Circuit has held that the patent in suit covers the use of oil in quantities up to one-half of one per cent. on the ore, and has granted an in-

junction against the use of such quantities and an accounting covering the period during which defendant used one-half of one per cent. or less.

(c)

Since this Court has squarely decided that the patent must be confined to the use of oil within the proportions often described in the testimony and in the patent as "critical proportions," "amounting to a fraction of one per cent. on the ore," and since the Court of Appeals has decided that such decision must be interpreted as limiting the monopoly of the patent to one-half of one per cent. or less, *the only territory regarding which there can be any possible dispute lies between one-half of one per cent. as the lower limit, and one per cent. as the upper limit.*

(d)

An examination of Defendant's Exhibit No. 158 (Rec., Vol. VI., p. 2882) shows that beginning in 1913 and down to January 7, 1917, the defendant always used less than one-half of one per cent. of oil (see column under "Per Cent. added," sub-title under "Per Ton Ore to Flotation," sub-title under "Oil—Amount and Analysis"). An accounting covering this period has already been ordered by the Court. of Appeals. This exhibit shows that for the week beginning January 9, 1917, the defendant used more than one per cent: of oil—to wit: 1.24%. It shows that during the two and one-half weeks between January 17, 1917, and February 3, 1917, defendant used more than one-half of one per cent. and less than one per cent.—to wit: 0.84% and 0.80%. It shows that subsequent thereto defendant always used one per cent. or more—to wit: 1.01% to 1.56%.*

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* The total quantity of oil present in the process after February 4 is shown in the column entitled, "Per Cent. Oil in Ore and Circulating Middling Treated in Flotation." Before February 4 no record was kept of the oil in the so-called "Circulating Load," and therefore no entries in this column appear before that date. Since a "Circulating Load" was always used and always carried oil, the amount of oil actually present in all cases was somewhat greater than that indicated in the column "Per Cent. added."

It appears, therefore, that down to January 7, 1917, defendant always used less than one-half of one per cent. and that after February 4, 1917, it always used more than one per cent. The only period, therefore, during which it used between one-half of one per cent. and one per cent. was the period of less than one month beginning January 17, 1917.*

THE COURT OF APPEALS DID NOTHING MORE THAN STUDY AND APPLY TO THE FACTS OF THIS CASE THE OPINION OF THIS COURT IN THE HYDE CASE.

This Court in the Hyde case said, in terms (242 U. S., 261, 271):

> "The investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions *often described in the testimony* and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore.'"

The questions for the Court of Appeals to determine, therefore, were: What were the "critical proportions" *often described by the witnesses in the Hyde case?* What was the fraction of one per cent. *described in the patent* as critical?

(a)

Turning to the patent itself, the Court of Appeals found that the critical proportions are there described as being *one-half of one per cent. or less*—preferably one-tenth of one per cent. It found that the *maximum quantity* described as suitable in the patent is one-half of one per cent. Thus:

In the introductory clause the patent refers to the Cattermole process, in which it says "an amount of oil varying from four per cent. to six per cent. of the *weight of the metalliferous matter present*" was employed. Simple arithmetic teaches us that 4% of the weight of the metalliferous matter in any ore which assays 25% metalliferous matter would be 1% on the ore (and an assay value as high as 20% is exceptional), so that 4% on the weight of the metalliferous matter in all ores assay-

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* The decision of this Court in the Hyde case was handed down December 11, 1916.

ing less than 25% would be "a fraction of one per cent." on the ore.

The specification continues (p. 1, line 28):

> "We have found that if the proportion of oily substance be *considerably reduced*—say to a fraction of one per cent. on the ore—," etc.

This Court knows from the record in the Hyde case that the Cattermole process was practiced by these plaintiffs on the tailings at the Broken Hill mine; and plaintiffs' expert, Dr. Chandler, in the Hyde case admitted (Rec., Vol. I., p. 529) that the Cattermole proportions applied to those Broken Hill tailings called for the use of only 1.2% to 1.8% on the ore. When the patent in suit says that the proportion of oil is to be "*considerably reduced*" below the Cattermole proportions, it must necessarily mean that the quantity of oil to be used is only a small fraction of one per cent.

The specifications say, in the example given beginning at page 1, line 70, that (p. 1, line 79):

> "To this is added a very small proportion of oleic acid (say from *0.02 per cent. to 0.5 per cent. on the weight of ore*)."

Again they say, page 1, line 96:

> "The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be *under 0.1 per cent.* of the ore; but this proportion has been found suitable and economical."

We, therefore, see that the "critical proportions" referred to by this Court in the Hyde case are defined in the specifications as being between *one-half of one per cent.* (0.5%) *and one-fiftieth of one per cent.* (0.02%), the preferred amount being *one-tenth of one per cent.* (0.1%).

(b)

Turning next to the record in the Hyde case (which by stipulation is made part of the record in this case—Rec., Vol. I., pp. 117 and 118) to ascertain what this Court referred to

when it defined the limits of the patent as being the "*proportions often described in the testimony*," the Court of Appeals found that these proportions were one-fifth of one per cent. or less—that is, the precise proportions described in the patent as preferable.

The testimony of plaintiff's witnesses in the Hyde case was thus summarized by plaintiffs' counsel in their brief before this Court.

Beginning on the very first page of that brief they said:

> "The distinctive feature of the invention patented is the employment of air bubbles in co-action with a *minute and critical* amount of oil in a mixture of ground ore and water so as to produce upon the surface of the water a froth containing substantially all of the metallic particles which can be easily flowed off or removed.
>
> "This process was never used before. This result was never obtained before. The process is dependent upon the use of oil in a *minute and critical* amount and thorough aeration. If *more* oil is used, you do not operate the process, and you do not get the result. So also if *less* oil is used the process is not operated and the result is not obtained. By using *other and greater* quantities of oil you operate a different process and you obtain wholly different results. That the *critical* amount of oil characterizing the process is a *minute* amount of oil (varying slightly with different ores and different oils) is merely a fortuitous circumstance. Nevertheless the process is *dependent upon such definite minute* amount of oil."

In their reply brief before this Court plaintiff's counsel stated, commencing at page 6:

> "It is the astonishing fact that, so far as the record here shows, with every ore the world over to which the process has been applied and with all the varying conditions of use, the *largest quantity ever used has been 4 pounds to the long ton (i. e., less than 2/10ths of one per cent.)*, and that the smallest quantity has been 9/10th of a pound per long ton of ore (*i. e.*, less than ¼ of 1/10th of 1 per cent.)."

These statements were repeated and emphasized in oral argument in the Hyde case. In this connection we refer to

the colloquy between two members of this Court and counsel for plaintiffs as follows (Rec., pp. 2948, 2949):

> "MR. JUSTICE MCREYNOLDS: I would like to ask you when in this process of reducing oil your invention came into existence?
>
> "MR. KENYON: At *about one-half of one per cent.* of oil.
>
> "MR. JUSTICE MCREYNOLDS: Before you got to the one-half of one per cent. did you have any invention?
>
> "MR. KENYON: We were passing from the region of Cattermole, which was a distinct—
>
> "MR. JUSTICE MCREYNOLDS: *I want to know when your invention came into existence?*
>
> "MR. KENYON: This invention was *not reached*, I should say, from those figures, until *about .5, that is, one-half of one per cent. of oil was reached.*
>
> "MR. JUSTICE MCREYNOLDS: At one per cent. you had no invention?
>
> "MR. KENYON: *No.*
>
> "MR. JUSTICE MCREYNOLDS: At one-half of one per cent. you did have invention?
>
> "MR. KENYON: *It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.*
>
> "MR. JUSTICE MCREYNOLDS: WHEN THIS FLOAT HAS MORE THAN ONE-HALF OF ONE PER CENT. OF OIL IT DOES NOT INFRINGE?
>
> "MR. KENYON: IT DOES NOT INFRINGE.
>
> "MR. JUSTICE PITNEY: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation.
>
> "MR. WILLIAMS: *Absolutely no.*
>
> "MR. KENYON: *It would not.*
>
> "MR. JUSTICE PITNEY: I understood him to say so yesterday, and I supposed there was something in the record to justify it.
>
> "MR. KENYON: *Nothing.* That will be a part of my argument."

Turning to the record in the Hyde case, the Court of Appeals found that *every witness examined on this point testified that quantities of oil above one-half of one per cent. (the maximum amount specified in the patent) were not capable of producing the desired results.*

Plaintiff's witness Dr. Chandler said in answer to x-Q. 42 (Rec., Vol. I., p. 197):

> "The inventors simply state, referring to the Cattermole patent which has just been previously discussed, that four to six per cent. of the weight of metalliferous matter present is employed, that they have found that if the proportion of oily substance be considerably reduced, say to a fraction of one per cent. on the ore, granulation ceases to take place. What this fraction of one per cent. is, they do not mention. *The only way in which I can interpret this fraction of one per cent. is by referring to other portions of the specification, where this fraction of one per cent. is expressed in figures;* for example, at line 81 of page 1 of the specification is the following statement, speaking of the ore:
>
> "'To this is added a very small proportion of oleic acid (say from *0.02 per cent. to 0.05 per cent.* on the weight of the ore).'
>
> "That is, from *1/50 of one per cent. up to one-half of one per cent.*"

Again, in answer to x-Q. 46 (Rec., Vol. I., p. 198), he said:

> "These *extremes represent from .4 of a pound per ton of ore to 10 pounds per ton of ore.** The patentees do not state on what particular condition of the ore this variation of quantity depends, whether it depends upon the percentage of zinc in the ore or some other quality, but they do indicate that the selection of quantity *between these extremes* must rest with the person familiar with the art who practices the process and it is fair to assume that such person would decide how much oleic acid to use by the results of the simple preliminary tests suggested by the patentees."

Plaintiffs' witness Ballantyne testified as follows (Rec., Vol. I., p. 286):

> "I have seen the agitation-froth process carried out many hundreds of times. I have also seen investigations of the process making wide variations step by step in the factors which I have referred to above, and I have myself, on many occasions, carried out these investiga-

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* 0.4 lbs. per ton is 0.02% and 10 lbs. per ton is 0.5%.

tions and now know that if the instructions which Messrs. Sulman, Picard and Ballot drew up in February, 1905, are carried out, namely to use a slimy pulp, acidified with say .5 per cent. of sulphuric acid, to heat the pulp say to 30° Centigrade and then to agitate it violently with proportions of oil beginning at fifty pounds of oil per ton of ore* and repeating this test, reducing the quantity of oil step by step down to the *vanishing point*, it is inevitable that the agitation-froth shall be produced when the *quantity of oil is diminished to the limits set forth in the patent in suit*, and that a particularly good froth and efficient concentration is obtained when the proportion of oil is about *0.1 per cent. on the ore*, the percentage recommended in the patent in suit as being suitable and economical."

In answer to x-Q. 102 he said (Rec., Vol. I., p. 323):

"In my opinion the operation of the agitation-froth process *is defined in the clearest possible terms in the patent in suit*, and this remark applies particularly to the *quantity of oil* to be used."

Further along in the same answer he said:

"I have never seen the agitation-froth process successfully carried out by the use of an amount of oil equal to practically one per cent. by weight on the ore, and *in my opinion 0.9999 per cent. of oil would not be a proper quantity* (that is to say, it would not be a suitable and economical quantity), as contemplated by the patent, and would not therefore be a *suitable fraction of one per cent. as contemplated by the patent.*"

The fact is that *not a single witness in the Hyde case said or intimated that the practical proportions included quantities above one-half of one per cent.* On the contrary, the plaintiffs' witnesses and plaintiffs' counsel assured this court that larger quantities could not be used and the process practiced. This being true, how could the Court of Appeals have interpreted the decision of this Court, which said that the "*patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as*

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*50 lbs. per ton is 2.5%.

' critical proportions ' ' amounting to a fraction of one per cent. on the ore ' ", otherwise than as holding that the valid claims were confined to the use of oil in quantities of one-half of one per cent. and less, which quantities the patent, plaintiffs' witnesses and plaintiffs' counsel, all told this court were the only quantities permissible in the practice of the process ?

The Court of Appeals, therefore, setting out to ascertain what were the " critical proportions " " often described in the testimony " to which this Court had in terms limited the patent, found that they were one-half of one per cent. or less. In other words it found that " *a* fraction of one per cent." in the claims means *that fraction of one per cent. which is half of one per cent. or less.*

II.

The petitioners are in error in alleging that the writ, if issued, will bring up for determination the question whether oils inactive in the process are to be taken into account in determining the question of infringement.

Defendant uses mixtures of oils and while the mixtures have varied, that which has been taken by both sides as typical, is the following : 24% pine oil, 65% fuel oil (which is a petroleum residuum) and 11% kerosene. Since fuel oil and kerosene differ only in specific gravity, both being petroleum, we may simplify the formula by saying that the mixture is composed of 24% pine oil and 76% petroleum—or, substantially, one part vegetable oil to three parts petroleum.

The petitioners say that the petroleum constituent of defendant's mixture of oils is inert in the process and should not be considered as the " oil " of the claims in determining the question of infringement. *Defendant denies that the petroleum constituent of its mixture of oils is inert in the process.*

This raises a pure question of fact which was fully considered by the Court of Appeals and, after studying the evidence, witnessing experiments, and making experiments itself, that Court found the fact to be that the petroleum constituent

of defendant's mixture is *not* inert in the process ; and that, therefore, it should be considered as the " oil " of the claims in determining the question of infringement. The Court of Appeals was never asked by the defendant to find, and it did not find, that anything inert in the process should be included in determining the amount of " oil " used.

What, therefore, the petitioners are asking now is that this Court should issue its writ of *certiorari* to review the finding of the Court of Appeals on a pure question of fact in dispute.

The testimony of the witnesses in this case (plaintiffs', as well as defendant's) and the testimony of its own senses, made it quite impossible for the Court of Appeals to find otherwise than that the petroleum constituent in defendant's mixture of oils is active in the process.

(a)

In the first place, the specifications and claims of the patent in suit define the oils to be used in the process as " oils or oily substances having a preferential affinity for metalliferous matter ". The petitioners before the Court of Appeals admitted that petroleum oils have such " preferential affinity for metalliferous matter ". They stated in their brief there (Brief, p. 4) :

> " It is conceded by both parties and found by the Court below that all oils possess the characteristic of preferential affinity for metalliferous matter over gangue."

Petroleum oils, therefore, fall strictly within the language of the claims of the patent in suit.

(b)

In the second place, this Court will remember that there is nothing novel in the use, in quantities above one per cent., of various oils (including petroleum and its derivatives) and various mixtures of oils.

It will remember that in the prior-art Haynes patent of 1860 (Rec., Vol. II., p. 766)—the earliest patent referred to—there is described the use of " bituminous matter (coal tar from gas works, and such like, for instance) gums, or gummy

matter (among others gutta percha, India rubber, for instance) and fatty or oleaginous matter" and that three examples of mixtures are given (Rec., p. 767), one being a mixture of coal tar and resin, another a mixture of "oily or fatty matter" with "bituminous, resinous, or waxy matter", and another a mixture of coal tar and gutta percha.

It will remember that in the prior-art Everson patent of 1886 (Rec., Vol. III., p 1209) there is described the use of "*petroleum* and one of its several constituents—namely, *paraffine oils*—also tallow (melted), lard, lard oil, red oil (impure oleic acid), cotton-seed oil, castor oil, sperm oil and linseed oil, and some combinations of these with each other."

It will remember that in the prior-art Elmore patent of 1901 (Rec., Vol. III., p. 1244) there is described the use of "*petroleum* after some of the lighter oils have been distilled from it."

It will remember that in the prior-art Glogner patent of 1903 (Rec., Vol. III., p. 1262) there is described the use of "*petroleum*."

It will remember that in the prior-art Cattermole patent of 1904, from the practice of which the invention in suit was directly developed (Rec., Vol. III., p. 1282), the following statement occurs (line 89):

> "The 'oil' used may be animal, vegetable or *mineral* oil or *mixtures of these*, or such coal or wood tar products or other substances which exercise, like oils, a preferential physical affinity for metallic mineral matter as distinguished from gangue."

It will remember that the prior-art Schwarz patent of 1905 (Rec., Vol. III., p. 1294) contains the following description: "Of normally liquid hydrocarbons there may be used any suitable vegetable, animal or *mineral* oil. These hydrocarbons may be used singly or in combination of two or more."

It will remember that in the prior-art Kirby patent of 1906 (Rec., Vol. III., p. 1316) there is described the use of "oil or a solution of bitumen in *kerosene*."

These prior art patents fully justify our statement that there is nothing novel in the use of quantities above one per cent. of various oils, including petroleum and its derivatives, and of various mixtures.

They go still further. It was never contended or even suggested in the Hyde case that the petroleums or mineral oils described in these patents would not effect the desired result if they had been used under suitable conditions in the critically minute quantities described in the patent in suit. In other words, if the petitioner's present contention that petroleum or mineral oils are not the "oil" of the claims were correct, they would have eliminated these prior patents which describe the use of petroleum by pointing out that fact. Instead of doing that, they admitted, as this Court found, that these prior processes differed essentially from the process of the patent in suit not in the fact that the former failed to describe oils suitable for the purpose, but in the fact that they failed to describe the use of the critically minute quantities of these oils to which this Court limited the field justly covered by the patentees.

(c)

In the third place, plaintiffs' witnesses, as well as defendant's witnesses, affirmatively stated in the Hyde case that the petroleum oils are active and useful in the process.

Crude petroleum as it comes from the wells is divided by what is termed "fractional distillation" into various grades, which are known in commerce as "gasolene", "kerosene", "fuel oil", "lubricating oil" and "residuum". That is to say, when crude oil is heated to say, 350° F., a certain amount of vapor is driven off and that vapor when condensed is sold as "gasolene". When the remainer is heated to say, 600° F., a certain additional amount of vapor is driven off and that vapor when condensed is sold as "kerosene". When the remainder is heated to certain higher temperature, an additional amount of vapor is driven off and that vapor when condensed is sold as "fuel oil". Higher temperatures yield "lubricating oil". That which is left after the "lubricating oil" has been distilled off is known as "residuum". These several grades differ from each other, therefore, only in their boiling points. That these various grades of petroleum (mineral oils) all have a "preferential affinity for metalliferous matter" is now admitted, and that all these various grades are useful in affecting froth concentration is affirmed or admitted by both plaintiff's and defendant's witnesses.

That petroleum (mineral oils) will produce froth and effect concentration was fully established out of the mouths of the patentees and plaintiffs' other witnesses in the Hyde case and in this case:

Thus, the patentees, Sulman and Picard, in their report to the chairman of Minerals Separation, being the first written description of the discovery of the invention at bar, said (Rec., Vol. II., p. 665):

> "We may here conveniently note that *other oils* besides oleic acid may be employed in this modified recovery process, but *so far as Broken Hill is concerned*, Oleic acid gives by far the best results. *Petroleum residuum* added as emulsion, *paraffine oil alone*, R_3P_1 and R_1P_3 emulsions,* have also been used, and *all give small proportions of float*, but do not act nearly so vigorously or efficiently *on Broken Hill ores* as plain Oleic acid."

The British patent which corresponds with the patent in suit, the complete specifications of which were filed later than the application for the patent in suit, describe in the working example the use not only of oleic acid but of "*petrol*† *or other suitable oil*" (Rec., Vol. II., p. 781). The reference to "petrol" as an equivalent to "oleic acid" appears five times in the specifications and claims.‡

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* "Petroleum residuum" referred to above is the heavier fractions left in the still after the gasolene and kerosene have been distilled off. "Paraffine oil" above referred to is the English name for *kerosene*. "R_3P_1" means a mixture of three parts residuum and one part paraffine oil, and "R_1P_3" means a mixture of one part residuum and three parts paraffine oil.

† "*Petrol*" is the English name for *gasolene*.

‡ The Provisional Specification of the British patent (Rec., Vol. II., p. 778) was filed April 12, 1905. It contained no mention of "petrol." The application for the patent in suit was filed May 29, 1905 (Rec., Vol. III., p. 1158) and is substantially a word-for-word copy of said Provisional Specification. The Complete Specification of the British patent (Rec., Vol. II., p. 780) was filed June 3, 1905; and this differs from the Provisional Specification in that wherever reference is made to the use of oleic acid in the process, "petrol" is specifically mentioned as an equivalent. From these facts it is evident that after the Provisional Specification was written and after the application papers for the United States patent were mailed to this country, and before the Complete Specification was written, the patentees had tried "petrol" (*i. e.*, gasolene) on Broken Hill ore and had found it was completely successful. They had previously tried petroleum residuum and kerosene on Broken Hill ore and had found that, while they produced a froth and effected concentration, they did not act as efficiently *with Broken Hill ore* as did oleic acid.

The patent in suit starts out (page 1, line 16) by referring to the Cattermole patents and says (line 28): "We have found that if the proportion of *oily substance* be considerably reduced," etc., the results of the patent in suit will be realized. This refers us directly to the said Cattermole for further information as to what are the "oily substances" referred to, and going there we find (Rec., Vol. III., p. 1282, line 89), the "oily substance" described as follows:

> "The 'oil' used may be animal, vegetable or *mineral* oil or *mixtures of these* or such coal or wood tar products or other substances which exercise, like oils, *a preferential physical affinity for metallic mineral matter as distinguished from gangue.*"

Further on, the specifications of the patent in suit say (p. 1, line 61):

> "The proportion of mineral which floats in the form of froth varies considerably with different ores and *with different oily substances*, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine *which oily substance* yields the proportion of froth or scum desired."

When we come to the claims we find that they define the oil as "*an oily liquid having a preferential affinity for metalliferous matter*," and see that this phrase is practically word-for-word the language used in the Cattermole patent.

Sulman, one of the patentees of the patent in suit, in a subsequently issued patent (No. 835,143), (Rec., Vol. III., p. 1309, line 15) says, referring to the patent here in suit:

> "In the process described in the specification of the previous patent application, Serial No. 262,889, filed May 29, 1905,* a mineral pulp is agitated with a small proportion of an oily substance, such as oleic acid *or petrol or other oil*, amounting to a fraction of one per cent. on the ore," etc.

---

* The "specification of the previous patent application" here referred to is the specification of the patent in suit.

Plaintiff's engineer, Higgins, testifying in the Hyde case (Rec., Vol. II., p. 1062), said:

> " Q. 110. What other oils?
> " A. I have obtained satisfactory results by the use of *petrol*, certain portions of the distillate of *crude petroleum, such as cosmos oil*, vegetable oil, such as palm oil, cotton-seed oil, linseed oil and animal oils, such as lard oil, and oil squeezed from beef fat.
> * * * * * * *
> " Q. 119. Will *Cosmos oil* in any quantity give as good a recovery as eucalyptus oil?
> " A. Yes, I think so.
> * * * * * * *
> " Q. 123. Is the Cosmos oil the Standard Oil Company's Cosmos oil.
> " A. Yes, the samples were obtained from their London firm, the Anglo-American Oil Company.

Plaintiffs' engineer, Chapman, in his testimony in the Hyde case (Rec., Vol. I., p. 245, Q. 112) stated that after making a large number of tests on the ore of the Braden mine in Chili, they adopted a mixture composed of " three pounds of Texas *fuel oil* and about one pound of American wood-tar oil per ton of ore," the amount used being, therefore, 0.2%. With this mixture he says:

> " we obtained recoveries of eighty-five to ninety per cent. of the copper content in a concentrate assaying ten to fifteen per cent. of copper, the original content being roughly three per cent. of copper. These results have been considerably improved in practice, and the installation of a very large plant at present, one thousand two hundred tons per day, is now taking place as a result of the trials carried out in a two hundred and fifty ton per day testing unit."

It will be observed that the mixture which plaintiffs themselves adopted and applied to the Braden ore is precisely the same mixture which defendant uses—*i. e.*, a three-to-one mixture of petroleum and vegetable oil—and that the fact such a mixture used in quantities of 0.2% was highly efficient in the practice of the process of the patent in suit was before this Court in the Hyde case. When defendant now uses precisely the same mixture in quantities above 1% on the ore,

plaintiffs argue, in their brief on this petitition (p. 23), that the petroleum constituent of the mixture is used

> " to throw a cloak of disguise over their operations by adding an alien and inoperative oil which does not change the essential character or operation or result of the process and which merely seeks to avoid the letter of the claim while keeping the substance of the invention."

All the foregoing testimony concerning the use and the usefulness of petroleum, alone and in mixtures, was before this Court in the Hyde case ; and yet plaintiffs' counsel say in their brief on this petition (pp. 19 and 20) :

> " fuel oil and kerosene oil, either alone or together, do not function or operate as the oil or oily substance of the process of the patent in suit and do not achieve the results described in the patent and in the opinion of this Court. That such oils would thus fail to operate when an effort was made to use them in the process in suit, did not appear in the evidence in the Hyde case. That such oils could be mixed with mineral-froth-forming oils capable of effectuating the process of the patent in suit and yet not destroy the action of the mineral-froth-forming oils in carrying on the process of the patent in suit was unknown when the evidence in the Hyde case was taken. It was a laboratory discovery made by one of the respondent's employees in the Summer of 1913."

And in a foot-note to page 20, answering defendant's contention that there is a fatal inconsistency between the contentions of the plaintiffs in the Hyde case on the issue of validity and their contentions in this case on the issue of infringement, they say :

> " But in the Hyde case no such special and peculiar oil mixtures were debated or considered or known as respondent in the instant case has found it possible to employ with its peculiar ore and with agitation of extraordinary violence. No such mixture was disclosed by the prior art in the Hyde case and no such mixture was used in the laboratory experiments there discussed in evidence and in argument. It follows from this that nothing that was there said has any bearing on the present issue of infringement."

So far from the facts being as thus stated in plaintiffs' brief on this petition, we have shown that it was established by the testimony of their own witnesses in the Hyde case that the fact that petroleum could be used as the " oil " of the process was stated by the patentees in their first written description of the process (although it was there coupled with the statement that it was less efficient than oleic acid with Broken Hill ore); was specifically mentioned as the " oil " of the process and as the equivalent of oleic acid in the British patent which corresponds with the patent in suit; was in a subsequent patent to one of the patentees described as the " oil " of the patent in suit and as the equivalent of oleic acid; was described as having been used as the " oil " of the process and having given satisfactory results by plaintiffs' witness Higgins; and when used in a three-to-one mixture with vegetable oil, precisely as defendant uses it, was described by plaintiffs' witness Chapman as the preferred " oil " of the process with some ores.

Plaintiffs' witness Higgins further says in this case that petroleum (fuel-oil and kerosene), when used with a vegetable oil are useful in the process in the patent in suit for the purpose of "*preventing the coarse mineral from falling out of the froth*" (Rec., Vol. V., p. 2612, Qs. 39 and 40); that it prevents "showering"—that is, it helps to keep the mineral from falling out of the froth (Rec., Vol. V., p. 2545, Qs. 421 and 422).

Furthermore, plaintiffs' witness Chapman, says in this case concerning petroleum (Rec., Vol. V., p. 2459, Q. 38):

> " I have on many occasions used inactive oils, particularly those like fuel-oil, kerosene and stove-oil to produce a *condition of froth* in the Spitz box that will maintain a steady condition of overflow. The addition of these re-agents in small quantities is *extremely useful* for this purpose, and considerably eases up the operating work."

That mineral oils in mixtures, such as defendant uses, are useful in flotation processes (and are not inert and mere diluents) is proved by the acts of plaintiffs' own licensees and others using mixtures in quantities in the neighborhood of one-tenth of one per cent.

Thus plaintiffs' licensee, the Braden Copper Company, uses a mixture of 1 pound of American wood tar oil to 3

pounds of Texas fuel oil (petroleum) per ton of ore, which is 0.2% (Rec., Vol. I., p. 245). At that place, therefore, the mixtures of oils used is precisely like that used by defendant, to-wit, one part vegetable oil to three parts of petroleum.

Again, plaintiffs' licensees at the Consolidated Arizona mine use between 2 and 3 pounds of oil to the ton of ore (*i. e.*, 0.1% to 0.15%), about one-half of it being Carolina turpentine, and the other half fuel oil and stove oil, both of which are petroleum (Rec., Vol. V., page 2292). At this place, therefore, the mixture of oils used is one part vegetable oil and one part petroleum.

Furthermore, the alleged infringers in this country when they used in the neighborhood of 0.1% on the ore, used a mixture containing petroleum as one of its components. This was true of the Utah Copper Company at its Magna plant, and also at its Arthur plant; it was true of the Chino Copper Company; and it was true of the Ray Consolidated Company.

Thus, at the Magna plant of the Utah Copper Company, when using about 0.1% of oil, they always used a mixture of which petroleum (Jones oil) was a constituent (Rec., Vol. III., p. 1584, x-Q. 268; also x-Q. 281, also x-Q. 286). Since they have used more than 1% of oil, they have continued to use Jones oil as a constituent of the mixture (Rec., Vol. III., p. 1586, x-Q. 289).

Thus, the Chino Copper Company, when using about 0.1% of oil, always used a mixture of which petroleum (Jones oil) was a constituent. Since they have used more than 1% of oil, they have continued to use Jones oil as a constituent of the mixture (Rec., Vol. III., p. 1449, x-Qs. 42 to 44).

Thus, the Ray Consolidated Company, when using about 0.1% of oil, they always used a mixture of which petroleum (fuel oil) was a constituent. Since they have used more than 1% of oil they have continued to use fuel oil as a constituent of the mixture (Rec., Vol. IV., p. 1865).

So, the practice of defendant in using a mixture of vegetable oil and petroleum is not peculiar to it, or to the use of quantities of oil above 1% on the ore.

That petroleum (mineral oils) will produce froth and affect concentration is also fully established by the testimony of defendant's witnesses:

For example, defendant's witness, Dosenbach, made an experiment before the District Court, using 25% kerosene or petroleum distillate and agitating it in the square-glass-jar machine. He obtained "a very copious highly-mineralized froth" (Rec., Vol. IV., p. 1893, Q. 58 to p. 1895, Q. 61). Not only did he obtain such a froth and give samples of it to the other side, but he produced an analysis of it. The experiment is known as No. 32, and the analysis appears in Defendant's Exhibit No. 304 (Rec., Vol. VI., following p. 3082, opposite the title "Kirby, Test No. 32"). The ore used was Utah copper containing 5.87% copper, 6.76% iron and 75.4% gangue ("Insol."). The assay of the concentrate showed that it contained 23.94% copper, 23.5% iron and 21.0% gangue ("Ins."). By this process, therefore, the copper content was raised from 5.87% to 23.94%, and the iron content was raised from 6.76% to 23.5%. Adding these figures together we see that the mineral content was raised from 12.63% to 47.44%, while the gangue content was reduced from 75.4% to 21.0%.

That petroleum is not, as contended on behalf of plaintiffs, inert in the process is also clearly demonstrated by the mill operations at the Arthur Plant of the Utah Copper Company, records of which appear in Defendant's Exhibit 31 (Rec., Vol. VI., following p. 2736), which are explained Record, Vol. III., p. 1515, Q. 59 *et seq.** The determinations given in detail in the footnote are not contradicted or questioned, and they

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* In one run (Experiment No. 7) the oil used was 20.33 pounds per ton, it being a mixture composed of 89% of what plaintiffs' witnesses call inactive oils; that is, petroleum (30% Jones fuel oil and 59% smelter fuel oil), and 11% of what they call active oils (10% American creosote and 1% of Yaryan pine oil). In this run the extraction was 98.4%, and the tailings carried 0.076% copper. The actual amount of so-called inactive oil used per ton was, therefore (being 89% of 20.33 pounds), 18.1 pounds, and the actual amount of so-called active oil used per ton was, therefore (being 11% of 20.33 pounds), 2.23 pounds. In another run (Experiment No. 30) *substantially the same amount of so-called active oil was used alone* (17.84 pounds of a mixture of the same petroleum; *i. e.*, smelter fuel and Jones fuel in the same proportions). *In this case the extraction was 95.06% and the tailings carried 0.306% copper.* In another run (Experiment No. 17) *substantially the same amount of so-called inactive oil was used alone* (1.97 pounds of a mixture of the same so-called active oils; that is, American creosote and Yaryan pine, in the same proportions). In this case the extraction was 85.72%, and the tailings carried 0.81% copper.

prove that the petroleum oil used in this process was by no means inactive or inert. They prove it was, indeed, quite as active and quite as efficient in producing the desired results as was the vegetable oil. Indeed, it will be observed that the petroleum when used alone gave higher extraction than did the vegetable oils when used alone. The highest extraction, however, was attained when they were used together in a mixture, as defendant uses them.

In direct contradiction of the theory of plaintiffs' counsel that petroleum is in inactive oil and plays no part in the production of foam, Wicks describes what happened one day in the mill of the Chino Copper Co. in the regular course of mill operations when the supply of petroleum was unintentionally shut off. He says the foam immediately disappeared, and no recoveries were obtained until the supply of petroleum was turned on again. At that time they were using 32.27 pounds of oil per ton of ore, *i. e.*, 1.6% (Rec., Vol. III., p. 1454, Qs.87-91).

Defendant's witness Puncheon describes similar occurrences intentionally produced in the regular course of mill operations at the Arthur plant, where a mixture of vegetable and mineral oils like that used by defendant was being employed. He says (Rec., Vol. IV., p. 2166, Q. 8 to Q. 20) that when the supply of mineral oil was cut off the froth gradually died away in the spitskasten and selective action ceased.

(d)

In the fourth place, experiments were made in the presence of the Court of Appeals by plaintiffs' experts designed to show that petroleum (particularly kerosene) would not produce a froth. What happened at that time was decribed in a foot-note to the printed report of the arguments of defendant's counsel handed to the Court after the hearing, and while this foot-note resulted in plaintiffs' counsel filing a supplemental brief, that supplemental brief did not deny the accuracy of the statements as to the production of froths, although, of course, they denied that the froths were the "same." Even this denial is immaterial because the only question being investigated was whether petroleum would or

would not produce a froth. The fact that petroleum has a preferential affinity for metal over gangue being admitted, it necessarily follows that froth, if produced, would affect concentration. That foot-note reads as follows :

"After the argument certain experiments were made in Court by plaintiffs in *bar-mixers* for the purpose of proving that the mineral-oil constituent of defendant's mixture when used alone will not produce a froth with defendant's ore. These were criticised by us because the volume treated in a bar-mixer is so small and the depth of liquid so insignificant that the foaming qualities of the contents is very largely masked and affords no fair indication of what happens in commercial machines.

"In the first bar-mixer experiment (called No. 6) 0.1% of kerosene alone was added to defendant's ore. After agitation the Court observed that an *excellent froth* was produced. There then was added to what was already in the bar-mixer, 0.1% of pine oil; and after agitation the Court observed that the same froth as before was produced, but its amount was somewhat increased. This experiment completely disproves plaintiffs' contention that kerosene alone will not produce a froth, and will not in a mixture contribute to the production of froth.

"In the second bar-mixer experiment (called No 7) there was added to defendant's ore a mixture of Jones' fuel oil and kerosene in the proportion in which these oils are used in defendant's mixture, and in an amount equivalent to that present in defendant's machines, so there was in the bar-mixer the entire mineral-oil constituent of defendant's mixture. After agitation the Court observed that an *excellent and voluminous froth* was produced. This experiment completely disproves plaintiff's contention that the mineral-oil constituent of defendant's mixture does not produce a froth with defendant's ore, and completely establishes what we offered to show (but were not permitted to show) that in our commercial machine (the Janney machine) the mineral-oil constituent of defendant's mixture will produce voluminous froth with defendant's ore. Finally, there was added to what was already in the bar-mixer, 0.2% of pine oil, which is the amount present in defendant's mixture, and after agitation the Court observed that the same froth as before was produced, but the amount was somewhat increased.

> "In the third bar-mixer experiment (called No. 8) 25% of kerosene was added to defendant's ore, and after agitation the Court observed that an *excellent and voluminous froth* was produced. Subsequently there was added to what was already in the bar-mixer 0.1% of pine-oil; and after agitation the Court observed that the same froth as before was produced, but its amount was somewhat increased. The froths produced in this experiment did not differ from the froths produced in the other experiments, except in that they were more oily in appearance—as they must necessarily be, owing to the fact that a larger proportion of oil was used. This experiment, therefore, disproves the contention of plaintiff's witnesses that a large percentage of kerosene will not produce a froth, and it verified the statements of defendant's witnesses that it will produce a froth."

(e)

Furthermore, after the argument the judges of the Court of Appeals themselves experimented with the process, having directed the parties to have their apparatus in evidence set up in a convenient place in the court house for that purpose.

III.

There is no Conflict of Decisions.

Petitioners nebulously intimate that there is a conflict between the decision of the Court of Appeals in this case and the decisions in the Miami case and in the House of Lords case.

In this connection it is sufficient to observe that conflict between the decision in this case and the decisions in those cases is utterly impossible, because the single point with which the decision in this case deals is whether the claims of the patent in suit held to be valid by this Court in the Hyde case, and those subsequently limited by disclaimer filed, cover the use of oil in quantities above a certain amount. Concerning the Miami case, petitioner's counsel admit in their

petition (p. 18) that "this point was not directly involved in the suit". That it could not have been involved in the House of Lords case goes without saying.

Respectfully submitted,

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Of Counsel for Respondent.

Amended Copy.

Supreme Court of the United States

OCTOBER TERM 1918.

No. 599.

Supreme Court, U. S.
SEP 4 1918
JAMES D. MAHER,
CLERK.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,

Respondent.

On Petition for a Writ of Certiorari to be addressed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit.

BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI AND APPENDED ANALYSIS BY QUOTATION OF THE OPINION OF THIS COURT IN MINERALS SEPARATION, LTD., V. HYDE, 242 U. S., 261.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
ODELL W. MCCONNELL,
Counsel for Petitioners.

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Supreme Court of the United States

MINERALS SEPARATION, LTD., MINERALS SEPARATION AMERICAN SYNDICATE, LTD., and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,
Respondent.

BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI.

The two questions involved are:

I. Did this Court by its decision in the Hyde case confine the patent in suit and all its valid claims to the use of *one-half of one per cent.* of oil or oily substance as the upper limit of the invention,—as the majority of the Circuit Court of Appeals in the instant case hold that it did, and

II. Did this Court by its decision in the Hyde case extend the patent and all its valid claims out to cover and include the use of *any and every* oil and oily substance having a preferential affinity for metalliferous matter over gangue, *regardless of the function and operation of* such oil or oily substance in the process and *regardless of the results* it obtains—as all three Judges of the Circuit Court of Appeals in the instant case hold that it did?

The answer to each of these questions is and must be in the negative. This Court made no such decision in the Hyde case.

For convenience we annex as an Appendix hereto (*infra*, pp. 26-32) an analysis (by quotations) of the decision of this Court in the Hyde case so far as material hereto; and we also annex to the Petition as an Appendix (Petition, p. 21) the three opinions of the three Judges of the Circuit Court of Appeals in the instant case, with annotations, and the later Order Modifying Decree which supplements and corrects an error in the opinion and decree of that Court as originally filed.

The decision and mandate of the Circuit Court of Appeals for the Ninth Circuit proceed entirely upon its interpretation of the decision of this Court in the Hyde case. (See, for example, Order Modifying Decree, Appendix to Petition, p. 43.) It discusses nothing else.

The Circuit Court of Appeals for the Third Circuit in the case against the Miami Copper Co. said, as to the decision and opinion of this Court in the Hyde case (244 Fed., 752, 758):

> "The Supreme Court did not construe the patent or determine its scope, for it had no occasion to do so. In the case before it, infringement was so clear that it had to be found if the patent was valid."

But, in the instant case, the Circuit Court of Appeals for the Ninth Circuit finds in the decision of this Court in the Hyde case a limitation of the invention and of all the claims to the use of one-half of one per cent. of oil or oily substance, and at the same time an extension of the invention and of all the claims to any and every oil and oily substance that has a preferential affinity for metalliferous matter over gangue, whether capable of doing the work of the process or not.

In the Hyde case the defendant had employed approximately one-tenth of one per cent. of oleic acid, which was the specific oily substance mentioned in the patent and the specific quantity mentioned as preferred; so no question of infringement arose which required discussion of the metes and bounds of the claims.

The question at issue was the question of invention.

The trial Court had found that a new process had been achieved which invoked a novel mode of operation and produced a novel and useful result and that it was patentable.

The Circuit Court of Appeals in that case had held that there was nothing novel in the ingredients or in the manipulation or in the mode of operation or in the result, that the only discovery was that an old process could be carried out in an old way to an old result with a very much smaller quantity of oil than previously used, that this discovery was useful only in that it saved oil but that this was a matter of degree and good engineering, and that no patentable invention had been made.

This Court in the Hyde case analyzed the prior art processes and the process in suit and contrasting them found and held (with the district court and contrary to the appellate court) that a new function of oil was utilized (namely, its froth-forming function as contrasted with buoyancy or agglutination), that a new mode of operation was introduced in the selection and lifting of the metallic particles of the pulp (namely, the buoyancy of air-bubbles as contrasted with the buoyancy of oil), and that a new result was obtained (namely, a froth composed of air-bubbles modified by the presence of a minute trace of oil in them and carrying a high percentage of the metal and metalliferous particles of the ore treated, as contrasted with an oil float carrying metal particles in the oil, or with the sinking of agglutinated granules).

This Court held that the process

> "differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery" (242 U. S., 266).

This Court concluded by saying:

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (*The Barbed Wire Patent*, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this Court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11" (242 U. S., 271).

There was here no holding, express or implied, that the claims of the patent that were held valid, for example, claims 1, 2, 3 and 12, were to be limited to one-half of one per cent. of oil or oily substance as claims 5, 6 and 7 are in so many words limited as to oleic acid.

Nor is there here any holding, express or implied, that the claims of the patent extend out to cover and include any oil or oily substance that has a preferential affinity for metalliferous matter over gangue whether it functions and operates as required by the process and produces the results achieved by the process, or not.

On the contrary it would apparently be the only proper inference to draw that this Court intended just the reverse in each particular.

I. *The Imputed Limitation to One-Half of One per Cent. of Oil.*

As to the limitation of the patent to the use of one-half of one per cent. of oil or oily substance, imputed to this Court by the majority of the Circuit Court of Appeals for the Ninth Circuit, the minority opinion there (Judge Morrow's) dissented, expressing the view that claims 1, 2, 3 and 12 should be read and understood in their natural meaning as they appear and as contrasted with claims 5, 6 and 7, and that this Court so intended, and that these claims 1, 2, 3 and 12 of the patent were held valid by this Court as covering and including the use of oil in any and every fraction of one per cent. that produced the novel results described. In this Judge Morrow agrees with the trial Judge in the instant case and with the three Judges of the Circuit Court of Appeals of the Third Circuit in the Miami case (244 Fed., 752), and in the matter of the natural meaning of claims 1, 2, 3 and 12, he agrees with the trial Judge and the three Judges of the Circuit Court of Appeals in the Hyde case itself (214 Fed., 100),* and with the trial Judge in the Miami case (237 Fed., 609).

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*Note the unquestioning acceptance of the fact that the patent covers any fraction up to a full one per cent. even by the Circuit Court of Appeals for the Ninth Circuit itself in the Hyde case.

"To discover that the desired result may be accomplished with the use of *a fraction of one per cent.* of oil when formerly a much larger quantity of oil had been used and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws" (214 Fed., 105).

And again

"That which is presented as new in the patent, and as the pivotal discovery on which its validity depends, is the formation of a froth or scum containing the metalliferous matter produced by agitation of the pulverized ore in water, by the action of *oil in a quantity less than one per cent.* of the quantity of ore treated" (214 Fed., 102).

And again.

"the quantity which is called for by the appellees' patent, *a fraction of one per cent*" (214 Fed., 104).

And again

"the appellees recommended *a fraction of one per cent. of oil*" (Ib.).

The contention that this Court in its Hyde decision intended to limit the scope of every valid claim in the patent to the use of one-half of one per cent. of oil on the ore was regarded in the trial court in the instant case as of so little consequence that it received no consideration in the opinion of the trial Judge, being merely adverted to as what the defendant contended (R., Vol. 1, p. 100). It first received emphasis in the appellate court when new counsel appeared for respondent. And of it Judge Morrow says in his dissenting opinion that it

> "was discovered by counsel for appellant in this case, and so far as appears from the record was revealed to the public for the first time in this Court."

The opinions of the Circuit Court of Appeals in the instant case are the first opinions in which the question is even discussed.

References in all of the prior opinions to the use of oil up to one per cent. on the ore as within the invention and the patent (seven opinions in all—including Judge Morrow's—representing the views of nine Circuit and District Judges—including Judge Ross himself in 1914*) are so unquestioning as to indicate general judicial acceptance of the fact that the broader claims have that as their natural meaning and go at least to that extent.

The majority of the appellate court in the instant case reached their conclusion as to the meaning in this regard of the Hyde opinion in this Court from the recital in that opinion of the history of the making of the invention, where, in the use of oleic acid on Broken Hill ore, under the particular conditions of grinding, acidifying, heating

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*Judge *Bourquin* in two opinions—in the Hyde case and in the instant case; Judge *Gilbert* on appeal in the Hyde case, concurred in by Judge *Ross* and Judge *Dietrich;* Judge *Bradford* in the Miami case; Judge *Woolley* on appeal in the Miami case, concurred in by Judge *McPherson;* Judge *Buffington* on appeal in the Miami case; and Judge *Morrow* on appeal in the instant case.

and agitation there present, it chanced that the reversal from the Cattermole metal-sinking result to the patentees' novel floating metal-froth result occurred at or about that point in the gradual reduction of the quantity of oleic acid used.

But that recital occurs in the course of the consideration of the question of invention and is given for its bearing on the finding that invention was involved. That history had been presented from that point of view by counsel for petitioners both in printed brief and in oral argument, as showing that the Circuit Court of Appeals must have been in error in its conclusion that the end achieved was merely economy in the use of oil. Counsel for petitioners there had pointed out that as the oleic acid was progressively reduced in the old Cattermole metal-sinking process, the granulation by which that process proceeded gradually diminished and finally disappeared, and that a new result in kind took its place and became progressively more and more pronounced as the oleic acid was still further reduced—the metal-sinking result giving place to the metal-floating result—a complete change of function and of operation and an exact reversal of result. The particular point (approximately one-half of one per cent. of oil to ore) where the reversal occurred in that particular instance was not germane to the argument of invention and it is important only to one who is using oleic acid with Broken Hill ore under the conditions then present and is material only to a question of infringement arising under claims 5, 6 and 7 of the patent in suit.

The reasoning imputed to this Court would seem to be this. Since in the case of oleic acid and Broken Hill ore the results obtained by the reduction in oil are to determine the limits of the invention for that case, in all other cases the results obtained are not to determine the limits of the invention—which reduces it to an absurdity.

Clearly the description in the opinion of this Court in the Hyde case of the details of the making of the discovery was given for its bearing on the issue of invention, and was not intended as a construction of the patent or as a limitation of the claims or as a hard and fast rule of quantity for all ores and all oils and all conditions.

This Court negatived beforehand any such intention when it said:

> "The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law" (242 U. S., 271).

The patent itself is explicit also in this regard when it says (p. 1, line 61):

> "The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired."

The majority of the Circuit Court of Appeals of the Ninth Circuit refer in confirmation (Judge Morrow dissenting) to a certain colloquy between two of the Justices

of this Court and two of the counsel for the petitioners at the oral argument.*

But this colloquy occurred in the course of the argument of invention referred to above and it had to do only with the specific case that was under discussion, namely, the use of oleic acid with Broken Hill ore.**

One of the majority judges (Judge Hunt) found his conclusion as to the meaning of the decision of this Court in this regard confirmed also by the patent at page 1, line 70 *et seq.* But this part of the specification is introduced by this language (p. 1, line 70):

> "The following is an example of the application of this invention to the concentration of a particular ore."

Preceding that, the invention is more broadly described as is usual in patent specifications.

The majority of the Circuit Court of Appeals confuse an example of an invention with the invention itself, an

*The colloquy in question was introduced in evidence at the trial in the instant case from the privately printed stenographic minutes of the oral arguments in the Hyde case (R. Vol. IV, pp. 2200-2202) and was pleaded (and urged in argument) as creating an estoppel against any claim for infringement by the respondent's use of more than one-half of one per cent. of any kind of oil or oily mixture (R., Vol. 1, p. 86). Of this Judge Bourquin said:

> "In the matter of estoppel affecting infringement, it suffices to say neither in pleading nor proof do the elements of estoppel appear" (R., Vol. 1, p. 102).

**No one who repeated exactly the patentees' March, 1905, experiments could obtain a useful mineral-carrying froth with more than one-half of one per cent. of *oleic acid* relative to ore and therefore as counsel said in that colloquy:

> "This invention was not reached, I should say, from these figures, until about .5, that is, one-half of one per cent. of oil was reached,"

and for those particular constituents under those particular conditions the upper limit marking the presence of the invention was one-half of one per cent. of oil. This was the meaning of the colloquy and it obviously can have no broader effect. Apparently Mr. Justice McReynolds, desiring to understand counsel's entire thought, asked the question he did to bring out that if the invention began at that point in the progressive reduction of oil then it had not existed above that point—which was and is perfectly true and is merely another way of stating the same thing. The colloquy did not go to construction of the patent or to limitation of the claims.

illustration with the thing illustrated, the particular with the general, the concrete with the abstract. They confuse the matter of claims and the scope of claims with the matter of description by illustration or example.

The patent statutes (e. g., Sec. 4888) require that an inventor explain the principle of his invention and the best mode in which he has contemplated applying that principle so as to distinguish it from other inventions, and particularly point out and distinctly claim the part, improvement or combination which he claims as his invention or discovery. But the details of "the best mode" do not limit the invention.

For instance this Court said in *U. S.* vs. *Societe Anonyme,* 224 U. S., 328,

> "We have seen De Bange described what he conceived to be the best form of his invention, and contemplated that it could be represented in other forms and proportions. This, however, was unnecessary, for the law would secure him against imitation by other forms and proportions. Winans vs. Denmead, 15 How., 330; Hotchkiss vs. Greenwood, 11 How., 248, 265; Western Electric Co. vs. La Rue, 139 U. S., 601, 608.
>
> "We think, therefore, that the court of claims rightfully decided the question of infringement against the government."

In *Telephone Cases,* 126 U. S., 1, 531, the patent described the magneto instrument as the best mode of producing the electrical undulations on the line wire by which human speech was transmitted. The argument was made that the patent should be confined to such a mode of producing those undulations. But this Court pointed out the broad character of the invention and of the claim for the art or method and the fact that the specification described the magneto method as the preferred method but added that the electrical undulations

could also be produced by alternately increasing and diminishing the resistance of the circuit or the power of the battery, and held infringement by one of the latter methods (126 U. S., 537).

Broad inventions may well reveal themselves in some specific embodiment wherein the idealizing mind of the inventor sees the broad principle through the accidental form. The present invention seems to have been of that sort, as pointed out by this Court in the Hyde case where, after the description of the details of the observations that revealed the invention, it is said:

> "It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface" (242 U. S., 267).

This Court thus found that the inventors here promptly recognized the broad fundamental novelty of their achievement and the broad principle of air-lift and air-flotation that they had called into being, and there is every presumption that that prompt recognition is reflected and expressed in the claims of the patent.

Thus this Court said in *Winans* vs. *Denmead*, 15 How., 330, 341:

> "Now, while it is undoubtedly true that the patentee may so restrict his claim as to cover less than what he invented, or may limit it to one particular form of machine, excluding all other forms, though they also embody his invention, yet such an interpretation

should not be put upon his claim if it can fairly be construed otherwise, and this for two reasons:

"1. Because the reasonable presumption is, that, having a just right to cover and protect his whole invention, he intended to do so (*Haworth* vs. *Hardcastle*, Web. P. C., 484).

"2. Because specifications are to be construed liberally, in accordance with the design of the Constitution and the patent laws of the United States, to promote the progress of the useful arts, and allow inventors to retain to their own use, not anything which is matter of common right, but what they themselves have created (*Grant* vs. *Raymond*, 6 Pet., 218; *Ames* vs. *Howard*, 1 Sumn., 482, 485; *Blanchard* vs. *Sprague*, 3 Id., 535, 539; *Daroll* vs *Brown*, 1 Wood. & M., 53, 57; *Parker* vs. *Haworth*, 4 McLean, 372; *Le Roy* vs. *Tatham*, 14 How., 181, and opinion of Parke, Baron, there quoted; *Neilson* vs. *Hartford*, *Web. P. C.*, 341; *Russel* vs. *Cowley*, Id., 470; *Burden* vs. *Winslow*, decided at the present term, 15 How.).

This Court in its decision in the Hyde case adopted the broad view of the inventors themselves that a new operation had been invoked and a new result obtained, and as a legal consequence this Court held that a patentable invention had been made, but confined the patent to the new results that gave the patent validity—which, while confining it in the case of oleic acid as used in March, 1905, on Broken Hill ore, to one-half of one per cent. of oleic acid on the ore, clearly had not the effect to so confine it in all cases.

The question whether or not claims 1, 2, 3 and 12 of the patent (claims that are not in terms limited, as the oleic acid claims 5, 6 and 7 are, to the use of one-half of one per cent. of oil or oily liquid) are nevertheless to be held so limited, did not arise on the facts in the Hyde case and was not even a collateral issue in that case, either on the question of infringement or on the question of invention. No testimony was taken by either side on any such issue and

no argument presented, as the briefs on file in this Court in that case demonstrate. Both sides unquestioningly accepted the patent as good for any and every fraction of one per cent. if good for anything at all. There is no discussion by this Court in its opinion as to one-half of one per cent. being the boundary line of the invention or of the claims; nor does this Court's holding that invention was present, nor the reasons on which that holding was based imply any such limitation.

This Court adjudged in the Hyde case that the patent must be confined to the results obtained by the process as there described and to that end it adjudged claims 9, 10 and 11 invalid as not so confined and claims 1, 2, 3, 5, 6, 7 and 12 valid as so confined. But this involved no judgment that the patent must be confined to details wherein certain of the claims held valid differed from certain other of the claims held valid. It involved no judgment that the patent must be confined to oleic acid to which claims 5, 6 and 7 are limited and claims 1, 2, 3 and 12 are not. And it no more involved a judgment that the patent must be confined to one-half of one per cent. of the oil or oily substance to which claims 5, 6 and 7 are limited but claims 1, 2, 3 and 12 are not.

The Circuit Court of Appeals for the Ninth Circuit in the instant case clings to the errors and mistakes of its own opinion in the Hyde case although those errors and mistakes have been already once corrected by this Court.

In presenting the reasons for their conclusion in the instant case the majority opinions of the Circuit Court of Appeals for the Ninth Circuit refer to and adopt its own previous opinion in the Hyde case in respect of the prior state of the art, as establishing that the results of the process of the patent in suit are identical with the results of the prior art processes except for a difference of degree, in this matter overlooking the conclusion of this Court in the

Hyde case that the results of the process of the patent in suit were never obtained before, that as contrasted with the Cattermole metal-sinking process the result was exactly reversed, and that, as contrasted with the surface flotation processes of the prior art, in all of them the lifting force of oil was chiefly relied upon, whereas in the process of the patent in suit the lifting force of air is principally relied upon, and in the prior processes an oil float or mass of floating oil carried the metal, whereas in the process of the patent in suit an air-froth carries the metal and in bubble films that are modified by the minute trace of oil in them.

The Circuit Court of Appeals for the Ninth Circuit in the Hyde case had put forward an entirely different view. It had classified the whole prior art, other than Elmore (i. e., Haynes, Everson, Froment, Kirby, Schwarz, Cattermole, etc.), with the process in suit as air-froth flotation processes. It had said (214 Fed., 106, 107):

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is less oil (as there must necessarily be) in the appellees' [patentees'] froth than in the others. The froths are all similar in appearance; they all rise to the surface after the same amount of agitation; they all gather with equal efficiency the same quantity of metal; and all may be removed from the surface in the same way" (214 Fed., 106, 107; bracketted insertion ours).

It had previously erroneously said of the Cattermole metal-sinking process (p. 106) that:

> "It was first required that the mixture be thoroughly agitated, and, as the result thereof, a froth necessarily came to the surface."

It had further said (p. 105):

> "To discover that the desired result may be accomplished with the use of a fraction of one per cent. of oil when formerly a much larger quantity of oil had been used, and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. *It is a difference of degree and not of kind.*" (Italics ours.)

The conclusion of law that followed from this was sustained by the citation of authorities which held that a difference of degree is not patentable, principally *Roberts* vs. *Ryer*, 91 U. S., 150, from which the following quotation was there made:

> "'A change only in form, proportions, or degree, doing substantially the same thing in the same way, by substantially the same means, with better results' * * * is not such invention as will sustain a patent."

This Court in the Hyde case did not reverse that Court on the proposition of law that where there is a difference of degree only and not a difference of kind it is not invention or discovery within the meaning of the patent laws, but this Court reversed that Court in the latter's findings of fact as to the relation of the process in suit to the processes of the prior art in the matter of the kind and character of the operation involved and of the results obtained.

In spite of this, the astonishing situation is presented that the majority of the Circuit Court of Appeals for the Ninth Circuit in the instant case reassert those conclusions of fact as to the prior art which this Court in its decision found to be erroneous.

Thus Judge Ross says (Appendix to Petition, p. 25):

> "certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this Court when this patent was last under consideration here and when the whole patent was by this Court held void as lacking invention (214 Fed., 100)."

And in quoting from the last paragraph of the opinion of this Court in the Hyde case Judge Ross makes a significant interpolation by way of observation, namely, after quoting the words,

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,'"

he interpolates the following (Appendix to Petition, p. 26):

> "(The former patents having used so much oil as to make its cost prohibitive—our observation.)"

Again Judge Hunt said (Appendix to Petition, p. 36):

> "But the froth developed in using the minute quantities of oil is, I think, essentially of a character like the froth shown when different quantities of oil are used—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this.
>
> "In the Cattermole process the froth was held to be distinguishable from the froth produced in the patented process," &c., * * *

If the statement of the first of the above quoted paragraphs refers to the "facts" of the prior art, it constitutes a persistence in findings of fact that have been discredited and reversed by this Court in the Hyde case.

The interpolation by Judge Ross quoted above discloses baldly the total misconception by that Court of the real nature of the invention, and the persistence of its original misconception that the inventors had achieved nothing more than a saving in the cost of oil—"so much *oil* as to make *its* cost prohibitive." (Italics ours.)

The reference by Judge Hunt to "the froth" of "the Cattermole process" is a persistence in the blunder of the Circuit Court of Appeals in the Hyde case in that regard which was corrected by this Court in that case. The Cattermole process is a metal-sinking process, as this Court has held. It does not produce a metal-carrying froth of any kind at any time.

As to Judge Hunt's reference to the experiments made "before us" proving that all the froths are alike, he is simply repeating the error of the three Judges of the same Court in the Hyde case. They said:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same * * *" (214 Fed., 106).

Only the practiced eye of the specially trained flotation expert, or the analyses of the assayer, can interpret what is observed and distinguish the real froth of the process in suit from a spurious froth.

The opinion of this Court in the Hyde case indicates that this Court was convinced from the evidence in that case that the above quoted statement of the Circuit Court of Appeals was erroneous, and the evidence in the instant case completely confirms that conclusion.

The conception of the majority of the Circuit Court of Appeals for the Ninth Circuit still is that the achievement of the patentees was merely a matter of economy of oil, a saving in the cost of oil, a matter of degree, and their

conception of the holding of this Court is that, owing to important practical advantages achieved, that saving of oil finally at some arbitrary point "rose to the dignity of *invention*," to employ the language of Judge Ross—"*invention in the process* began to appear," to employ the language of Judge Hunt.

But this is a fundamentally erroneous conception of the invention and of the decision of this Court in the Hyde case and it is perhaps not strange that it should lead to artificial and arbitrary limitations and extensions of the invention and of the patent without basis in operation or result and without basis in reason. *

II. *The matter of oils and oily substances that do not function or operate to achieve the process or to obtain the results.*

During the period of infringement in question (from January 7th, 1917, down to the time of trial, commencing immediately after and in consequence of the decision of this Court in the Hyde case) respondent continuing to use substantially the same minute proportion of frothing oil of the patent (pine oil) that it had used during the period of admitted infringement, added to it sufficient fuel oil

*Judge Bourquin in his admirable decision in the instant case discusses at length the issue of invalidity because the respondent in the trial court presented new evidence as to the prior art (both fact evidence and expert evidence) and as to the mill use of large oil quantities in the process, and featured in brief and argument the defense of total invalidity of the patent because of that new evidence. Judge Bourquin in conclusion as to that evidence said (R., Vol. 1, p. 99):

> "If it be conceded that new evidence might warrant and demand that a trial court hold invalid a patent by the Supreme Court held valid, such evidence must be unequivocal, clear and convincing, in quality and quantity that inspires confidence and produces conviction that the patent is invalid and that the Supreme Court would so determine beyond a reasonable doubt. Not only does it fail here, but it strengthens the conviction that the patent is valid."

In the Circuit Court of Appeals the new counsel appearing on behalf of respondent practically abandoned the defense of invalidity and featured non-infringement.

and kerosene to bring the aggregate at first above one-half of one per cent. and later slightly above one per cent.

Counsel for respondent admitted in the Circuit Court of Appeals for the Ninth Circuit in the instant case as it had admitted at the trial, that this was done not for any metallurgical or financial advantage (there was loss in both) but merely to escape the terms of the patent as it conceived them to have been defined by this Court in the Hyde case.*

It was proved at the trial and found by the trial Judge to be the fact, and the fact was not questioned by the Circuit Court of Appeals for the Ninth Circuit, that fuel oil and kerosene oil, either alone or together, do not function or operate as the oil or oily substance of the process of the patent in suit and do not achieve the results described in the patent and in the opinion of this Court.

That such oils would thus fail to operate when an effort was made to use them in the process in suit, did not appear in the evidence in the Hyde case. That such oils could be mixed with mineral-froth-forming oils capable of effectuating the process of the patent in suit and yet not destroy the action of the mineral-froth-forming oils in carrying on the process of the patent in suit was unknown

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*From the brief filed by the respondent in the instant case in the Circuit Court of Appeals we quote as follows:

"Defendant does not use more than 1% of oil because it cannot use less and obtain more satisfactory results. It uses it because the Supreme Court has said it is not at liberty to use less than 0.5% but that it is at liberty to use more than that. Out of abundance of caution, and dreading the fire like every burned child, defendant has used not only more than 0.5%, but it has used more than 1% of oil on the ore. To respect the property rights of the plaintiff as defined by the Supreme Court is, as we have shown (*supra*, p. 25), costing the defendant in reduced recoveries and increased costs over a million dollars a year."

Judge Bourquin in his opinion in the instant case in the District Court said (R., Vol. 1, p. 100):

"Defendant practically admits that it now uses the present amount of oil merely to avoid the patent. It is done, says its counsel in argument, 'because the Supreme Court has said it is not at liberty to use less than one-half per cent.,' and 'out of abundance of caution' it uses 'more than one per cent.'"

when the evidence in the Hyde case was taken.* It was a laboratory discovery made by one of the respondent's employees in the summer of 1913 (R., Vol. IV, p. 1941, XQ361). This employee later experimented with thousands of oils (p. 1942, XQ370). An employee of the Utah Copper Co., another infringer, investigated such oils for two years in the laboratory (R., Vol. III, pp. 1509-10, Q12 to 17). An employee of the Ray Consolidated Co., another infringer, testified "We tried at different times to run on straight fuel oil, but we could never obtain metallurgical results" (R., Vol. IV, p. 1871, Q78).

It was proved at the trial, and found by the trial Judge as a fact, and was not questioned by the Circuit Court of Appeals, that fuel oil and kerosene have totally different characteristics in the process from oleic acid or pine oil and are incapable of the essential bubble-making function of oleic acid or pine oil or other oils of the patent and are incapable of the essential bubble-making function required by the process and are incapable of forming the oil-coated mineral particles into a froth, as required by the patent and by all the claims, and that the final effect of adding such alien and merely diluent oil was, not to change the kind or character of the process, or of the operation, or of the result, but merely to lower the grade of the concentrate and to diminish the percentage of the recovery and the capacity of the plant.

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*It was argued on behalf of respondent in the Circuit Court of Appeals that petitioners were in some way dealing unfairly with the courts and with the public in arguing infringement in the instant case, in view of their arguments of novelty and invention presented in the Hyde case. But in the Hyde case no such special and peculiar oil mixtures were debated or considered or known as respondent in the instant case has found it possible to employ with its peculiar ore and with agitation of extraordinary violence. No such mixture was disclosed by the prior art in the Hyde case and no such mixture was used in the laboratory experiments there discussed in evidence and in argument. It follows from this that nothing that was there said has any bearing on the present issue of infringement.

Nevertheless the Circuit Court of Appeals for the Ninth Circuit disregarded these facts and held that this Court had held in the Hyde case that every oil was the oil of the patent regardless of its function or operation in the process, and they counted the weight of the fuel oil and the kerosene that was added in determining whether the limit of one-half of one per cent. of oil to ore had been exceeded and they regarded nothing else as material on the issue of infringement, neither function nor mode of operation nor result, nor did they consider any question of equivalency.

Thereby the decision of the Circuit Court of Appeals for the Ninth Circuit in the instant case, if allowed to stand, renders the patent in suit valueless and the invention unprotected, and the decision of this Court in the Hyde case nugatory, even where the oil or oily liquid that will do the work of the process is used in the minute fraction of one-tenth of one per cent. on the ore or in any other "critical proportions" that are within the range of the claims, because the same results in kind can be achieved by the process in suit by anyone who intermixes with such oil of the process in "critical proportions" an alien and merely diluent oil or oily substance so that the aggregate is above the range of the claims.

No question of distinction between one kind of oil and another arose in the Hyde case because defendant there employed the very oily substance (oleic acid) that is given in the example of the patent and it produced exactly the same result in exactly the same way by exactly the same means.

But implicit in the decision of this Court in the Hyde case (and implicit in the patent) is the requirement that the oil, to be the oil of the process, must function as there set out and must produce the results there described. This Court sustained the patent as valid because it held that the process

developed and utilized a new quality of oil, to wit, the bubble-making or froth-making quality, and achieved a new operation thereby, namely, preferential selection and lifting of the metallic particles through the pulp by air-bubbles, and obtained a new result, namely, a metal-carrying air-froth (the films of whose bubbles have been modified and so made persistent by the minute trace of oil in them). The only oil or oily substance specifically mentioned in the patent is oleic acid (the patent in suit is sharply contrasted with the Cattermole patents in that regard). Oleic acid will develop the bubble-making quality called for by the process. This has been abundantly proved. That quality is clearly indicated in the specification as a necessary quality of the oil of the process by its description of the air-lift operation (p. 1, line 92) and of the air-bubbles or air-films carrying the mineral particles (p. 1, lines 89-91, 93-95, 98-99; p. 2, lines 112-115; p. 3, lines 27-30), and by its caution that each new ore and each new oil requires a preliminary test to ascertain which oil or oily substance will yield the froth desired (p. 1, lines 61-69). And the claims explicitly limit the process, and so the re-agents and conditions of the process, to such as will *form the oil-coated mineral particles into a froth*—claims 1, 2, 3, 5, 6, 7 and 12 in so many words, and claims 9, 10 and 11 as the legal effect of the disclaimer. And that quality is clearly indicated as a necessary quality of the oil of the process by the express holding of this Court in the Hyde case that *the patent must be confined to the results obtained in the process as described in the patent and as practiced in the mill*, namely, this air-froth with its modified air-films carrying the mineral particles, for it is a corollary of this holding that the patent cannot cover, and none of its claims can cover, the use of an oil or oily substance (in any proportion no matter how small) *that will not and cannot produce that result.* There can be no "critical proportions" for such an oil or oily substance

in the process because such substance cannot effectuate the process. Such an oil or oily substance is not the equivalent of the oleic acid of the patent, for it will not do the work of the oleic acid in the process, and it is not the oil, or oily substance, of the claims. And if added in admixture with an oil or oily substance that does the work of the process and obtains the novel results, such added diluent oil or oily substance is no more to be considered or counted than would any other alien and inoperative diluent. And this would be true whether such added oil were useful for other purposes or not, as for stabilizing the froth after it is once formed.

This misapplication in the present case of the opinion of this Court in the Hyde case, results in nullifying the value of a patent adjudged to be valid by this Court, in that it opens the door to infringers, even those who use as low as one-tenth of one per cent. of mineral-froth-forming oil, to throw a cloak of disguise over their operations by adding an alien and inoperative oil which does not change the essential character or operation or result of the process and which merely seeks to avoid the letter of the claim while keeping the substance of the invention. And yet the Circuit Court of Appeals for the Ninth Circuit took the same account of this inoperative fuel oil and kerosene oil that it took of the operative pine oil to which latter alone the essential functioning of the process was due.

It was proved at the trial and was found by the trial Judge and is not controverted by the Circuit Court of Appeals that the process of the respondent after January 7th, 1917, proceeded in all its essential operations by the *beneficial use* of a minute fraction of one per cent. (about one-tenth to two-tenths of one per cent. or less on the ore) of an oil or oily substance (pine oil) that had been used for several years prior to that date in admitted infringement

of the patent, and this was the basis of the finding of the trial Court that defendant employed the process of the patent in suit after that date just as much as it employed the process before that date, used the same elements, in the same combination, in the same way, with the same function, to the same but poorer results. Yet the Circuit Court of Appeals for the Ninth Circuit regarded only the matter of oil saving and disregarded wholly the real process and the factors that did the real work of the process. It did not adopt or apply in determining the issue of infringement those criteria of the invention that this Court applied and announced in the Hyde decision in determining the issue of validity.

On the contrary it adopted and applied "oil-saving" criteria that persisted from its own previous decision in the Hyde case, but such criteria had been discredited and superseded by the reversal of that decision by this Court and the manner of that reversal.

As set forth in the accompanying petition, the decree, although interlocutory in form, finally determines all issues that have been contested herein. It was in all respects final as originally entered, and was altered to its present form because the Circuit Court of Appeals had overlooked defendant's admission of infringement for the period prior to the decision of this Court in the Hyde case. This alteration was effected without altering the opinions of the Court upon the disputed issues. The contention therefore, should it be made, that the writ of certiorari should be denied because the decree in its present form is not in all respects a final decree, has no sound basis as a reason for the denial of the petition at this time.

As to the question of power, that has already been decided in prior cases, *Forsyth* vs. *Hammond*, 166 U. S., 506, *American Co.* vs. *Jacksonville Co.*, 148 U. S., 372, 383, *Denver* vs. *New York Trust Co.*, 229 U. S., 123.

As to the question of propriety, there is in the instant case not only the same variance between the decisions of the House of Lords and of the Circuit Court of Appeals for the Ninth Circuit in fundamental conception of the process in relation to the prior art that formed the basis for the application for the writ in the Hyde case, and the added variance in that same regard between the decisions of the Circuit Court of Appeals for the Third Circuit in the Miami case and the Circuit Court of Appeals for the Ninth Circuit here, but, what is even more important, there is in the instant case such misinterpretation and misapplication of the decision of this Court in the Hyde case as amounts in fact to a non-acceptance of the latter by the lower court and renders the same in effect wholly nugatory. Confusion and uncertainty as to the meaning of the decision of this Court in the Hyde case have been created in a great and widespread industry by the decision of the Circuit Court of Appeals in the instant case, at a time when certainty and uniformity of decision is especially important.

An accounting as to admitted infringement can in no possible way assist this Court in effectuating its decision in the Hyde case and, if conducted on a theory of the invention which is held ultimately to have been fundamentally erroneous, it may not benefit your petitioners, and certainly will not help the public, or conserve the due administration of the law.

In conclusion it is submitted that the Petition for Writ of Certiorari should be granted.

Respectfully submitted,

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
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Appendix.

ANALYSIS BY QUOTATION OF THE OPINION OF THIS COURT IN THE HYDE CASE (242 U. S., 261).

This Court in the Hyde case held with the District Court and contrary to the Circuit Court of Appeals that the process

> "differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery."

In reaching that conclusion this Court began by pointing out that all kindred prior oil processes

> "speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass —'the pulp'— thus formed so as to separate *the oil*, when *it* became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue." (Italics ours.)

The Court divided the processes of this general character described in prior patents roughly into two classes and said of the first class, or "Surface Flotation Process,"

> "it depends for its usefulness on *the oil* used *being sufficient* to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and *by its buoyancy* to carry them to the surface of the mixture of ore, water and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrate thus obtained into any desired receptacle." (Italics ours.)

It said that the process of the other class, known as the "Metal-Sinking Process,"

> "reverses the action of the Surface Flotation Process and is illustrated by the Cattermole U. S. Patent No. 777273, in which oil is used to the extent of 4% to 6% to 10% of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water."

The Court then pointed out that the process of the patent in suit

> "as described and practiced, consists in the use of an amount of oil which is 'critical' and minute as compared with the amount used in prior processes 'amounting to a fraction of one per cent. on the ore,' and in so impregnating with air the mass of ore and water used, by agitation—'by beating the air in the mass'—as to cause to rise to the surface of the mass, or pulp, *a froth,* peculiarly coherent and persistent in character, which is composed *of air bubbles with only a trace of oil in them,* which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment." (Italics ours.)

It was at this point that the Court announced its conclusion first quoted above that it is obvious that the process of the patent in suit is not of the Metal-Sinking class and while it may in terms be described as a Surface Flotation Process, yet it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that the Court is persuaded that

> "it constitutes a new and patentable discovery."

The Court then referred to the prior processes as requiring

> "the use of so much oil that they were too expensive to be used on lean ores,"

and instancing Froment and Kirby; Froment as

> "little more than a laboratory experiment"

and Kirby

> "though approaching in some respects more nearly to the end attained by the process of the patent in suit"

as finding

> "its preferred application in the use of an amount of oil solution equal to one-fourth to three-fourths in weight of the ore treated, which was prohibitive in cost."

The Court then recited briefly the history of the discovery (clearly for its bearing on the question of invention) saying:

> "The experimeters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid was used. *This froth,* on collection, was found to consist *of air bubbles modified by the presence of the minute amount of oil used* and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly rec-

> ognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, *which air, in bubbles,* attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and *floated* them to the surface." (Italics ours.)

This Court then quoted as not an over statement of fact the following:

> " 'The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before.' "

The Court then said that it was convinced

> "that the small amount of oil used makes it clear that *the lifting force* which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force *is to be found, chiefly in the buoyancy of the air bubbles* introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical." (Italics ours.)

This Court then expressed its agreement with the House of Lords where in speaking of the process Lord Shaw said:

> " 'They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a

method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid.' "

And Lord Atkinson said:

" 'In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop, or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water.' "

This Court then referred to the immediate and extensive use made of the process as persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect.

The Court held as untenable

"the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be *within the scope of the claims*, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. *The composition of ores*

varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment *within the terms of the claims,* while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law." (Italics ours.)

As to infringement (where the only contention of the defendant was that the facts had not been proved) all that the Court said was:

"The evidence of infringement is clear."

In conclusion the Court said:

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (*The Barbed Wire Patent,* 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to *the results obtained* by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7 and 12, and that the

defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."* (Italics ours.)

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*The difference in phraseology between claims 1, 2, 3, 5, 6, 7 and 12 on the one hand, and claims 9, 10 and 11 on the other hand, *in the matter of the "results" to be "obtained,"* is that in all the claims of the former group it is prescribed that the froth must be formed or constituted *by the oil-coated mineral particles*, whereas in all the claims of the latter group the only prescription is that "a froth," any sort of froth, is to be formed.

Thus claims 1, 2 and 3, say agitate

"until the oil-coated mineral matter forms into a froth";

and claim 12 says agitate

"to cause the oil-coated mineral to form a froth";

and claims 5, 6 and 7 say agitate

"until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith."

Whereas claims 9, 10 and 11 merely say agitate

"to form a froth."

The difference in phraseology between the two groups of claims *in the matter of oil quantity* is as follows.

Claims 5, 6 and 7 specify

"a small proportion of oleic acid amounting to 0.02—0.5 per cent on the ore";

claim 12 specifies

"a fraction of one per cent. of oil on the ore";

claims 1, 2 and 3 specify

"a small proportion of an oily liquid having a preferential affinity for metalliferous matter, (amounting to a fraction of one per cent. on the ore)."

Whereas claims 9, 10 and 11 specify

"a small quantity of oil."

The opinion of this Court in the Hyde case was filed on December 11th, 1916. The mandate was issued on January 13th, 1917, and was filed in the United States District Court for the District of Montana on March 5th, 1917.

On the 28th day of March, 1917, Minerals Separation, Ltd., one of your petitioners and the sole owner then and now of the legal title to the Letters Patent in suit, filed its disclaimer in the United States Patent Office reciting the decision of this Court in the Hyde case and in pursuance thereof disclaiming:

"From claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore" (R., Vol. I, p. 61).

The disclaimer was held valid by Judge Bourquin (R., Vol I, p. 90) and by Judge Morrow (Appendix to Petition, p. 41; R., Vol. VI, p. 3111). Judge Ross' opinion as originally filed found non-infringement and ordered dismissal of the bill without regard to the question raised respecting the sufficiency of the disclaimer or its resultant effect, but in his opinion as corrected the disclaimer was not referred to and affirmance was adjudged as to the admitted infringement. Judge Hunt's opinion does not refer to the disclaimer. Therefore Judge Morrow affirms Judge Bourquin as to the disclaimer and Judges Ross and Hunt do not reverse him as to the disclaimer. Thus both Courts are in agreement as to the legality, sufficiency and timeliness of the disclaimer and the validity of claims 9, 10 and 11 as limited by disclaimer, although the same conflict as to construction of these claims as thus limited exists as to claims 1, 2, 3 and 12.

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Supreme Court of the United States

OCTOBER TERM 1918.

No. 599

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,

Respondent.

On Petition for a Writ of Certiorari to be addressed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit.

BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI.

HENRY D. WILLIAMS,
WM. HOUSTON KINYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
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Supreme Court of the United States

MINERALS SEPARATION, LTD., MINERALS SEPARATION AMERICAN SYNDICATE, LTD., and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,
Respondent.

BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI.

The two questions involved are:

I. Did this Court by its decision in the Hyde case confine the patent in suit and all its valid claims to the use of *one-half of one per cent.* of oil or oily substance as the upper limit of the invention,—as the majority of the Circuit Court of Appeals in the instant case hold that it did, and

II. Did this Court by its decision in the Hyde case extend the patent and all its valid claims out to cover and include the use of *any and every* oil and oily substance having a preferential affinity for metalliferous matter over gangue, *regardless of the function and operation of* such oil or oily substance in the process and *regardless of the results* it obtains—as all three Judges of the Circuit Court of Appeals in the instant case hold that it did?

The answer to each of these questions is and must be in the negative. This Court made no such decision in the Hyde case.

For convenience we annex as an Appendix hereto (*infra*, pp. 26-32) an analysis (by quotations) of the decision of this Court in the Hyde case so far as material hereto; and we also annex to the Petition as an Appendix (Petition, p. 21) the three opinions of the three Judges of the Circuit Court of Appeals in the instant case, with annotations, and the later Order Modifying Decree which supplements and corrects an error in the opinion and decree of that Court as originally filed.

The decision and mandate of the Circuit Court of Appeals for the Ninth Circuit proceed entirely upon its interpretation of the decision of this Court in the Hyde case. (See, for example, Order Modifying Decree, Appendix to Petition, p. 42.) It discusses nothing else.

The Circuit Court of Appeals for the Third Circuit in the case against the Miami Copper Co. said, as to the decision and opinion of this Court in the Hyde case (244 Fed., 752, 758):

> "The Supreme Court did not construe the patent or determine its scope, for it had no occasion to do so. In the case before it, infringement was so clear that it had to be found if the patent was valid."

But, in the instant case, the Circuit Court of Appeals for the Ninth Circuit finds in the decision of this Court in the Hyde case a limitation of the invention and of all the claims to the use of one-half of one per cent. of oil or oily substance, and at the same time an extension of the invention and of all the claims to any and every oil and oily substance that has a preferential affinity for metalliferous matter over gangue, whether capable of doing the work of the process or not.

In the Hyde case the defendant had employed approximately one-tenth of one per cent. of oleic acid, which was the specific oily substance mentioned in the patent and the specific quantity mentioned as preferred; so no question of infringement arose which required discussion of the metes and bounds of the claims.

The question at issue was the question of invention.

The trial Court had found that a new process had been achieved which invoked a novel mode of operation and produced a novel and useful result and that it was patentable.

The Circuit Court of Appeals in that case had held that there was nothing novel in the ingredients or in the manipulation or in the mode of operation or in the result, that the only discovery was that an old process could be carried out in an old way to an old result with a very much smaller quantity of oil than previously used, that this discovery was useful only in that it saved oil but that this was a matter of degree and good engineering, and that no patentable invention had been made.

This Court in the Hyde case analyzed the prior art processes and the process in suit and contrasting them found and held (with the district court and contrary to the appellate court) that a new function of oil was utilized (namely, its froth-forming function as contrasted with buoyancy or agglutination), that a new mode of operation was introduced in the selection and lifting of the metallic particles of the pulp (namely, the buoyancy of air-bubbles as contrasted with the buoyancy of oil), and that a new result was obtained (namely, a froth composed of air-bubbles modified by the presence of a minute trace of oil in them and carrying a high percentage of the metal and metalliferous particles of the ore treated, as contrasted with an oil float carrying metal particles in the oil, or with the sinking of agglutinated granules).

This Court held that the process

> "differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery" (242 U. S., 266).

This Court concluded by saying:

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (*The Barbed Wire Patent,* 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this Court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7 and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11" (242 U. S., 271).

There was here no holding, express or implied, that the claims of the patent that were held valid, for example, claims 1, 2, 3 and 12, were to be limited to one-half of one per cent. of oil or oily substance as claims 5, 6 and 7 are in so many words limited as to oleic acid.

Nor is there here any holding, express or implied, that the claims of the patent extend out to cover and include any oil or oily substance that has a preferential affinity for metalliferous matter over gangue whether it functions and operates as required by the process and produces the results achieved by the process, or not.

On the contrary it would apparently be the only proper inference to draw that this Court intended just the reverse in each particular.

I. *The Imputed Limitation to One-Half of One per Cent. of Oil.*

As to the limitation of the patent to the use of one-half of one per cent. of oil or oily substance, imputed to this Court by the majority of the Circuit Court of Appeals for the Ninth Circuit, the minority opinion there (Judge Morrow's) dissented, expressing the view that claims 1, 2, 3 and 12 should be read and understood in their natural meaning as they appear and as contrasted with claims 5, 6 and 7, and that this Court so intended, and that these claims 1, 2, 3 and 12 of the patent were held valid by this Court as covering and including the use of oil in any and every fraction of one per cent. that produced the novel results described. In this Judge Morrow agrees with the trial Judge in the instant case and with the three Judges of the Circuit Court of Appeals of the Third Circuit in the Miami case (244 Fed., 752), and in the matter of the natural meaning of claims 1, 2, 3 and 12, he agrees with the trial Judge and the three Judges of the Circuit Court of Appeals in the Hyde case itself (214 Fed., 100),* and with the trial Judge in the Miami case (237 Fed., 609).

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*Note the unquestioning acceptance of the fact that the patent covers any fraction up to a full one per cent. even by the Circuit Court of Appeals for the Ninth Circuit itself in the Hyde case.

"To discover that the desired result may be accomplished with the use of *a fraction of one per cent.* of oil when formerly a much larger quantity of oil had been used and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws" (214 Fed., 105).

And again

"That which is presented as new in the patent, and as the pivotal discovery on which its validity depends, is the formation of a froth or scum containing the metalliferous matter produced by agitation of the pulverized ore in water, by the action of *oil in a quantity less than one per cent.* of the quantity of ore treated" (214 Fed., 102).

And again.

"the quantity which is called for by the appellees' patent, *a fraction of one per cent*" (214. Fed., 104),

And again

"the appellees recommended *a fraction of one per cent. of oil*" (Ib.).

The contention that this Court in its Hyde decision intended to limit the scope of every valid claim in the patent to the use of one-half of one per cent. of oil on the ore was regarded in the trial court in the instant case as of so little consequence that it received no consideration in the opinion of the trial Judge, being merely adverted to as what the defendant contended (R., Vol. 1, p. 100). It first received emphasis in the appellate court when new counsel appeared for respondent. And of it Judge Morrow says in his dissenting opinion that it

> "was discovered by counsel for appellant in this case, and so far as appears from the record was revealed to the public for the first time in this Court."

The opinions of the Circuit Court of Appeals in the instant case are the first opinions in which the question is even discussed.

References in all of the prior opinions to the use of oil up to one per cent. on the ore as within the invention and the patent (seven opinions in all—including Judge Morrow's—representing the views of nine Circuit and District Judges—including Judge Ross himself in 1914*) are so unquestioning as to indicate general judicial acceptance of the fact that the broader claims have that as their natural meaning and go at least to that extent.

The majority of the appellate court in the instant case reached their conclusion as to the meaning in this regard of the Hyde opinion in this Court from the recital in that opinion of the history of the making of the invention, where, in the use of oleic acid on Broken Hill ore, under the particular conditions of grinding, acidifying, heating

*Judge *Bourquin* in two opinions—in the Hyde case and in the instant case; Judge *Gilbert* on appeal in the Hyde case, concurred in by Judge *Ross* and Judge *Dietrich;* Judge *Bradford* in the Miami case; Judge *Woolley* on appeal in the Miami case, concurred in by Judge *McPherson;* Judge *Buffington* on appeal in the Miami case; and Judge *Morrow* on appeal in the instant case.

and agitation there present, it chanced that the reversal from the Cattermole metal-sinking result to the patentees' novel floating metal-froth result occurred at or about that point in the gradual reduction of the quantity of oleic acid used.

But that recital occurs in the course of the consideration of the question of invention and is given for its bearing on the finding that invention was involved. That history had been presented from that point of view by counsel for petitioners both in printed brief and in oral argument, as showing that the Circuit Court of Appeals must have been in error in its conclusion that the end achieved was merely economy in the use of oil. Counsel for petitioners there had pointed out that as the oleic acid was progressively reduced in the old Cattermole metal-sinking process, the granulation by which that process proceeded gradually diminished and finally disappeared, and that a new result in kind took its place and became progressively more and more pronounced as the oleic acid was still further reduced—the metal-sinking result giving place to the metal-floating result—a complete change of function and of operation and an exact reversal of result. The particular point (approximately one-half of one per cent. of oil to ore) where the reversal occurred in that particular instance was not germane to the argument of invention and it is important only to one who is using oleic acid with Broken Hill ore under the conditions then present and is material only to a question of infringement arising under claims 5, 6 and 7 of the patent in suit.

The reasoning imputed to this Court would seem to be this. Since in the case of oleic acid and Broken Hill ore the results obtained by the reduction in oil are to determine the limits of the invention for that case, in all other cases the results obtained are not to determine the limits of the invention—which reduces it to an absurdity.

Clearly the description in the opinion of this Court in the Hyde case of the details of the making of the discovery was given for its bearing on the issue of invention, and was not intended as a construction of the patent or as a limitation of the claims or as a hard and fast rule of quantity for all ores and all oils and all conditions.

This Court negatived beforehand any such intention when it said:

> "The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law" (242 U. S., 271).

The patent itself is explicit also in this regard when it says (p. 1, line 61):

> "The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired."

The majority of the Circuit Court of Appeals of the Ninth Circuit refer in confirmation (Judge Morrow dissenting) to a certain colloquy between two of the Justices

of this Court and two of the counsel for the petitioners at the oral argument.*

But this colloquy occurred in the course of the argument of invention referred to above and it had to do only with the specific case that was under discussion, namely, the use of oleic acid with Broken Hill ore.**

One of the majority judges (Judge Hunt) found his conclusion as to the meaning of the decision of this Court in this regard confirmed also by the patent at page 1, line 70 *et seq.* But this part of the specification is introduced by this language (p. 1, line 70):

> "The following is an example of the application of this invention to the concentration of a particular ore."

Preceding that, the invention is more broadly described as is usual in patent specifications.

The majority of the Circuit Court of Appeals confuse an example of an invention with the invention itself, an

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*The colloquy in question was introduced in evidence at the trial in the instant case from the privately printed stenographic minutes of the oral arguments in the Hyde case (R., Vol. , p.) and was pleaded and urged in argument as creating an estoppel against any claim for infringement by the respondent's use of more than one-half of one per cent. of any kind of oil or oily mixture (R., Vol. 1, p. 86). Of this Judge Bourquin said:

> "In the matter of estoppel affecting infringement, it suffices to say neither in pleading nor proof do the elements of estoppel appear" (R., Vol. 1, p. 102).

**No one who repeated exactly the patentees' March, 1905, experiments could obtain a useful mineral-carrying froth with more than one-half of one per cent. of *oleic acid* relative to ore and therefore as counsel said in that colloquy:

> "This invention was not reached, I should say, from these figures, until about .5, that is, one-half of one per cent. of oil was reached," and for those particular constituents under those particular conditions the upper limit marking the presence of the invention was one-half of one per cent. of oil. This was the meaning of the colloquy and it obviously can have no broader effect. Apparently Mr. Justice McReynolds, desiring to understand counsel's entire thought, asked the question he did to bring out that if the invention began at that point in the progressive reduction of oil then it had not existed above that point—which was and is perfectly true and is merely another way of stating the same thing. The colloquy did not go to construction of the patent or to limitation of the claims.

illustration with the thing illustrated, the particular with the general, the concrete with the abstract. They confuse the matter of claims and the scope of claims with the matter of description by illustration or example.

The patent statutes (e. g., Sec. 4888) require that an inventor explain the principle of his invention and the best mode in which he has contemplated applying that principle so as to distinguish it from other inventions, and particularly point out and distinctly claim the part, improvement or combination which he claims as his invention or discovery. But the details of "the best mode" do not limit the invention.

For instance this Court said in *U. S.* vs. *Societe Anonyme*, 224 U. S., 328,

> "We have seen De Bange described what he conceived to be the best form of his invention, and contemplated that it could be represented in other forms and proportions. This, however, was unnecessary, for the law would secure him against imitation by other forms and proportions. Winans vs. Denmead, 15 How., 330; Hotchkiss vs. Greenwood, 11 How., 248, 265; Western Electric Co. vs. La Rue, 139 U. S., 601, 608.
>
> "We think, therefore, that the court of claims rightfully decided the question of infringement against the government."

In *Telephone Cases*, 126 U. S., 1, 531, the patent described the magneto instrument as the best mode of producing the electrical undulations on the line wire by which human speech was transmitted. The argument was made that the patent should be confined to such a mode of producing those undulations. But this Court pointed out the broad character of the invention and of the claim for the art or method and the fact that the specification described the magneto method as the preferred method but added that the electrical undulations

could also be produced by alternately increasing and diminishing the resistance of the circuit or the power of the battery, and held infringement by one of the latter methods (126 U. S., 537).

Broad inventions may well reveal themselves in some specific embodiment wherein the idealizing mind of the inventor sees the broad principle through the accidental form. The present invention seems to have been of that sort, as pointed out by this Court in the Hyde case where, after the description of the details of the observations that revealed the invention, it is said:

> "It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface" (242 U. S., 267).

This Court thus found that the inventors here promptly recognized the broad fundamental novelty of their achievement and the broad principle of air-lift and air-flotation that they had called into being, and there is every presumption that that prompt recognition is reflected and expressed in the claims of the patent.

Thus this Court said in *Winans* vs. *Denmead*, 15 How., 330, 341:

> "Now, while it is undoubtedly true that the patentee may so restrict his claim as to cover less than what he invented, or may limit it to one particular form of machine, excluding all other forms, though they also embody his invention, yet such an interpretation

should not be put upon his claim if it can fairly be construed otherwise, and this for two reasons:

"1. Because the reasonable presumption is, that, having a just right to cover and protect his whole invention, he intended to do so (*Haworth* vs. *Hardcastle*, Web. P. C., 484).

"2. Because specifications are to be construed liberally, in accordance with the design of the Constitution and the patent laws of the United States, to promote the progress of the useful arts, and allow inventors to retain to their own use, not anything which is matter of common right, but what they themselves have created (*Grant* vs. *Raymond*, 6 Pet., 218; *Ames* vs. *Howard*, 1 Sumn., 482, 485; *Blanchard* vs. *Sprague*, 3 Id., 535, 539; *Davoll* vs *Brown*, 1 Wood. & M., 53, 57; *Parker* vs. *Haworth*, 4 McLean, 372; *Le Roy* vs. *Tatham*, 14 How., 181, and opinion of Parke, Baron, there quoted; *Neilson* vs. *Hartford*, *Web. P. C.*, 341; *Russel* vs. *Cowley*, Id., 470; *Burden* vs. *Winslow*, decided at the present term, 15 How.).

This Court in its decision in the Hyde case adopted the broad view of the inventors themselves that a new operation had been invoked and a new result obtained, and as a legal consequence this Court held that a patentable invention had been made, but confined the patent to the new results that gave the patent validity—which, while confining it in the case of oleic acid as used in March, 1905, on Broken Hill ore, to one-half of one per cent. of oleic acid on the ore, clearly had not the effect to so confine it in all cases.

The question whether or not claims 1, 2, 3 and 12 of the patent (claims that are not in terms limited, as the oleic acid claims 5, 6 and 7 are, to the use of one-half of one per cent. of oil or oily liquid) are nevertheless to be held so limited, did not arise on the facts in the Hyde case and was not even a collateral issue in that case, either on the question of infringement or on the question of invention. No testimony was taken by either side on any such issue and

no argument presented, as the briefs on file in this Court in that case demonstrate. Both sides unquestioningly accepted the patent as good for any and every fraction of one per cent. if good for anything at all. There is no discussion by this Court in its opinion as to one-half of one per cent. being the boundary line of the invention or of the claims; nor does this Court's holding that invention was present, nor the reasons on which that holding was based imply any such limitation.

This Court adjudged in the Hyde case that the patent must be confined to the results obtained by the process as there described and to that end it adjudged claims 9, 10 and 11 invalid as not so confined and claims 1, 2, 3, 5, 6, 7 and 12 valid as so confined. But this involved no judgment that the patent must be confined to details wherein certain of the claims held valid differed from certain other of the claims held valid. It involved no judgment that the patent must be confined to oleic acid to which claims 5, 6 and 7 are limited and claims 1, 2, 3 and 12 are not. And it no more involved a judgment that the patent must be confined to one-half of one per cent. of the oil or oily substance to which claims 5, 6 and 7 are limited but claims 1, 2, 3 and 12 are not.

The Circuit Court of Appeals for the Ninth Circuit in the instant case clings to the errors and mistakes of its own opinion in the Hyde case although those errors and mistakes have been already once corrected by this Court.

In presenting the reasons for their conclusion in the instant case the majority opinions of the Circuit Court of Appeals for the Ninth Circuit refer to and adopt its own previous opinion in the Hyde case in respect of the prior state of the art, as establishing that the results of the process of the patent in suit are identical with the results of the prior art processes except for a difference of degree, in this matter overlooking the conclusion of this Court in the

Hyde case that the results of the process of the patent in suit were never obtained before, that as contrasted with the Cattermole metal-sinking process the result was exactly reversed, and that, as contrasted with the surface flotation processes of the prior art, in all of them the lifting force of oil was chiefly relied upon, whereas in the process of the patent in suit the lifting force of air is principally relied upon, and in the prior processes an oil float or mass of floating oil carried the metal, whereas in the process of the patent in suit an air-froth carries the metal and in bubble films that are modified by the minute trace of oil in them.

The Circuit Court of Appeals for the Ninth Circuit in the Hyde case had put forward an entirely different view. It had classified the whole prior art, other than Elmore (i. e., Haynes, Everson, Froment, Kirby, Schwarz, Cattermole, etc.), with the process in suit as air-froth flotation processes. It had said (214 Fed., 106, 107):

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is less oil (as there must necessarily be) in the appellees' [patentees'] froth than in the others. The froths are all similar in appearance; they all rise to the surface after the same amount of agitation; they all gather with equal efficiency the same quantity of metal; and all may be removed from the surface in the same way" (214 Fed., 106, 107; bracketted insertion ours).

It had previously erroneously said of the Cattermole metal-sinking process (p. 106) that:

> "It was first required that the mixture be thoroughly agitated, and, as the result thereof, a froth necessarily came to the surface."

It had further said (p. 105):

> "To discover that the desired result may be accomplished with the use of a fraction of one per cent. of oil when formerly a much larger quantity of oil had been used, and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. *It is a difference of degree and not of kind.*" (Italics ours.)

The conclusion of law that followed from this was sustained by the citation of authorities which held that a difference of degree is not patentable, principally *Roberts* vs. *Ryer*, 91 U. S., 150, from which the following quotation was there made:

> "'A change only in form, proportions, or degree, doing substantially the same thing in the same way, by substantially the same means, with better results' * * * is not such invention as will sustain a patent."

This Court in the Hyde case did not reverse that Court on the proposition of law that where there is a difference of degree only and not a difference of kind it is not invention or discovery within the meaning of the patent laws, but this Court reversed that Court in the latter's findings of fact as to the relation of the process in suit to the processes of the prior art in the matter of the kind and character of the operation involved and of the results obtained.

In spite of this, the astonishing situation is presented that the majority of the Circuit Court of Appeals for the Ninth Circuit in the instant case reassert those conclusions of fact as to the prior art which this Court in its decision found to be erroneous.

Thus Judge Ross says (Appendix to Petition, p. 25):

> "certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this Court when this patent was last under consideration here and when the whole patent was by this Court held void as lacking invention (214 Fed., 100)."

And in quoting from the last paragraph of the opinion of this Court in the Hyde case Judge Ross makes a significant interpolation by way of observation, namely, after quoting the words,

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,'"

he interpolates the following (Appendix to Petition, p. 26):

> "(The former patents having used so much oil as to make its cost prohibitive—our observation.)"

Again Judge Hunt said (Appendix to Petition, p. 36):

> "But the froth developed in using the minute quantities of oil is, I think, essentially of a character like the froth shown when different quantities of oil are used—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this.
>
> "In the Cattermole process the froth was held to be distinguishable from the froth produced in the patented process," &c., * * *

If the statement of the first of the above quoted paragraphs refers to the "facts" of the prior art, it constitutes a persistence in findings of fact that have been discredited and reversed by this Court in the Hyde case.

The interpolation by Judge Ross quoted above discloses baldly the total misconception by that Court of the real nature of the invention, and the persistence of its original misconception that the inventors had achieved nothing more than a saving in the cost of oil—"so much *oil* as to make *its* cost prohibitive." (Italics ours.)

The reference by Judge Hunt to "the froth" of "the Cattermole process" is a persistence in the blunder of the Circuit Court of Appeals in the Hyde case in that regard which was corrected by this Court in that case. The Cattermole process is a metal-sinking process, as this Court has held. It does not produce a metal-carrying froth of any kind at any time.

As to Judge Hunt's reference to the experiments made "before us" proving that all the froths are alike, he is simply repeating the error of the three Judges of the same Court in the Hyde case. They said:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same * * *" (214 Fed., 106).

Only the practiced eye of the specially trained flotation expert, or the analyses of the assayer, can interpret what is observed and distinguish the real froth of the process in suit from a spurious froth.

The opinion of this Court in the Hyde case indicates that this Court was convinced from the evidence in that case that the above quoted statement of the Circuit Court of Appeals was erroneous, and the evidence in the instant case completely confirms that conclusion.

The conception of the majority of the Circuit Court of Appeals for the Ninth Circuit still is that the achievement of the patentees was merely a matter of economy of oil, a saving in the cost of oil, a matter of degree, and their

conception of holding of this Court is that, owing to important practical advantages achieved, that saving of oil finally at some arbitrary point "rose to the dignity of *invention*," to employ the language of Judge Ross—"*invention in the process* began to appear," to employ the language of Judge Hunt.

But this is a fundamentally erroneous conception of the invention and of the decision of this Court in the Hyde case and it is perhaps not strange that it should lead to artificial and arbitrary limitations and extensions of the invention and of the patent without basis in operation or result and without basis in reason. *

II. *The matter of oils and oily substances that do not function or operate to achieve the process or to obtain the results.*

During the period of infringement in question (from January 7th, 1917, down to the time of trial, commencing immediately after and in consequence of the decision of this Court in the Hyde case) respondent continuing to use substantially the same minute proportion of frothing oil of the patent (pine oil) that it had used during the period of admitted infringement, added to it sufficient fuel oil

*Judge Bourquin in his admirable decision in the instant case discusses at length the issue of invalidity because the respondent in the trial court presented new evidence as to the prior art (both fact evidence and expert evidence) and as to the mill use of large oil quantities in the process, and featured in brief and argument the defense of total invalidity of the patent because of that new evidence. Judge Bourquin in conclusion as to that evidence said (R., Vol. 1, p. 99):

> "If it be conceded that new evidence might warrant and demand that a trial court hold invalid a patent by the Supreme Court held valid, such evidence must be unequivocal, clear and convincing, in quality and quantity that inspires confidence and produces conviction that the patent is invalid and that the Supreme Court would so determine beyond a reasonable doubt. Not only does it fail here, but it strengthens the conviction that the patent is valid."

In the Circuit Court of Appeals the new counsel appearing on behalf of respondent practically abandoned the defense of invalidity and featured non-infringement.

and kerosene to bring the aggregate at first above one-half of one per cent. and later slightly above one per cent.

Counsel for respondent admitted in the Circuit Court of Appeals for the Ninth Circuit in the instant case as it had admitted at the trial, that this was done not for any metallurgical or financial advantage (there was loss in both) but merely to escape the terms of the patent as it conceived them to have been defined by this Court in the Hyde case.*

It was proved at the trial and found by the trial Judge to be the fact, and the fact was not questioned by the Circuit Court of Appeals for the Ninth Circuit, that fuel oil and kerosene oil, either alone or together, do not function or operate as the oil or oily substance of the process of the patent in suit and do not achieve the results described in the patent and in the opinion of this Court.

That such oils would thus fail to operate when an effort was made to use them in the process in suit, did not appear in the evidence in the Hyde case. That such oils could be mixed with mineral-froth-forming oils capable of effectuating the process of the patent in suit and yet not destroy the action of the mineral-froth-forming oils in carrying on the process of the patent in suit was unknown

*From the brief filed by the respondent in the instant case in the Circuit Court of Appeals we quote as follows:

> "Defendant does not use more than 1% of oil because it cannot use less and obtain more satisfactory results. It uses it because the Supreme Court has said it is not at liberty to use less than 0.5% but that it is at liberty to use more than that. Out of abundance of caution, and dreading the fire like every burned child, defendant has used not only more than 0.5%, but it has used more than 1% of oil on the ore. To respect the property rights of the plaintiff as defined by the Supreme Court is, as we have shown (*supra*, p. 25), costing the defendant in reduced recoveries and increased costs over a million dollars a year."

Judge Bourquin in his opinion in the instant case in the District Court said (R., Vol. 1, p. 100):

> "Defendant practically admits that it now uses the present amount of oil merely to avoid the patent. It is done, says its counsel in argument, 'because the Supreme Court has said it is not at liberty to use less than one-half per cent.,' and 'out of abundance of caution' it uses 'more than one per cent.'"

when the evidence in the Hyde case was taken.* It was a laboratory discovery made by one of the respondent's employees in the summer of 1913 (R., Vol. , p. 1941, XQ361). This employee later experimented with thousands of oils (p. 1942, XQ370). An employee of the Utah Copper Co., another infringer, investigated such oils for two years in the laboratory (R., Vol , pp. 1508-9, Q12 to 17). An employee of the Ray Consolidated Co., another infringer, testified "We tried at different times to run on straight fuel oil, but we could never obtain metallurgical results" (R., Vol. , p. 1871, Q78).

It was proved at the trial, and found by the trial Judge as a fact, and was not questioned by the Circuit Court of Appeals, that fuel oil and kerosene have totally different characteristics in the process from oleic acid or pine oil and are incapable of the essential bubble-making function of oleic acid or pine oil or other oils of the patent and are incapable of the essential bubble-making function required by the process and are incapable of forming the oil-coated mineral particles into a froth, as required by the patent and by all the claims, and that the final effect of adding such alien and merely diluent oil was, not to change the kind or character of the process, or of the operation, or of the result, but merely to lower the grade of the concentrate and to diminish the percentage of the recovery and the capacity of the plant.

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*It was argued on behalf of respondent in the Circuit Court of Appeals that petitioners were in some way dealing unfairly with the courts and with the public in arguing infringement in the instant case, in view of their arguments of novelty and invention presented in the Hyde case. But in the Hyde case no such special and peculiar oil mixtures were debated or considered or known as respondent in the instant case has found it possible to employ with its peculiar ore and with agitation of extraordinary violence. No such mixture was disclosed by the prior art in the Hyde case and no such mixture was used in the laboratory experiments there discussed in evidence and in argument. It follows from this that nothing that was there said has any bearing on the present issue of infringement.

Nevertheless the Circuit Court of Appeals for the Ninth Circuit disregarded these facts and held that this Court had held in the Hyde case that every oil was the oil of the patent regardless of its function or operation in the process, and they counted the weight of the fuel oil and the kerosene that was added in determining whether the limit of one-half of one per cent. of oil to ore had been exceeded and they regarded nothing else as material on the issue of infringement, neither function nor mode of operation nor result, nor did they consider any question of equivalency.

Thereby the decision of the Circuit Court of Appeals for the Ninth Circuit in the instant case, if allowed to stand, renders the patent in suit valueless and the invention unprotected, and the decision of this Court in the Hyde case nugatory, even where the oil or oily liquid that will do the work of the process is used in the minute fraction of one-tenth of one per cent. on the ore or in any other "critical proportions" that are within the range of the claims, because the same results in kind can be achieved by the process in suit by anyone who intermixes with such oil of the process in "critical proportions" an alien and merely diluent oil or oily substance so that the aggregate is above the range of the claims.

No question of distinction between one kind of oil and another arose in the Hyde case because defendant there employed the very oily substance (oleic acid) that is given in the example of the patent and it produced exactly the same result in exactly the same way by exactly the same means.

But implicit in the decision of this Court in the Hyde case (and implicit in the patent) is the requirement that the oil, to be the oil of the process, must function as there set out and must produce the results there described. This Court sustained the patent as valid because it held that the process

developed and utilized a new quality of oil, to wit, the bubble-making or froth-making quality, and achieved a new operation thereby, namely, preferential selection and lifting of the metallic particles through the pulp by air-bubbles, and obtained a new result, namely, a metal-carrying air-froth (the films of whose bubbles have been modified and so made persistent by the minute trace of oil in them). The only oil or oily substance specifically mentioned in the patent is oleic acid (the patent in suit is sharply contrasted with the Cattermole patents in that regard). Oleic acid will develop the bubble-making quality called for by the process. This has been abundantly proved. That quality is clearly indicated in the specification as a necessary quality of the oil of the process by its description of the air-lift operation (p. 1, line 92) and of the air-bubbles or air-films carrying the mineral particles (p. 1, lines 89-91, 93-95, 98-99; p. 2, lines 112-115; p. 3, lines 27-30), and by its caution that each new ore and each new oil requires a preliminary test to ascertain which oil or oily substance will yield the froth desired (p. 1, lines 61-69). And the claims explicitly limit the process, and so the re-agents and conditions of the process, to such as will *form the oil-coated mineral particles into a froth*—claims 1, 2, 3, 5, 6, 7 and 12 in so many words, and claims 9, 10 and 11 as the legal effect of the disclaimer. And that quality is clearly indicated as a necessary quality of the oil of the process by the express holding of this Court in the Hyde case that *the patent must be confined to the results obtained in the process as described in the patent and as practiced in the mill*, namely, this air-froth with its modified air-films carrying the mineral particles, for it is a corollary of this holding that the patent cannot cover, and none of its claims can cover, the use of an oil or oily substance (in any proportion no matter how small) *that will not and cannot produce that result*. There can be no "critical proportions" for such an oil or oily substance

in the process because such substance cannot effectuate the process. Such an oil or oily substance is not the equivalent of the oleic acid of the patent, for it will not do the work of the oleic acid in the process, and it is not the oil, or oily substance, of the claims. And if added in admixture with an oil or oily substance that does the work of the process and obtains the novel results, such added diluent oil or oily substance is no more to be considered or counted than would any other alien and inoperative diluent. And this would be true whether such added oil were useful for other purposes or not, as for stabilizing the froth after it is once formed.

This misapplication in the present case of the opinion of this Court in the Hyde case, results in nullifying the value of a patent adjudged to be valid by this Court, in that it opens the door to infringers, even those who use as low as one-tenth of one per cent. of mineral-froth-forming oil, to throw a cloak of disguise over their operations by adding an alien and inoperative oil which does not change the essential character or operation or result of the process and which merely seeks to avoid the letter of the claim while keeping the substance of the invention. And yet the Circuit Court of Appeals for the Ninth Circuit took the same account of this inoperative fuel oil and kerosene oil that it took of the operative pine oil to which latter alone the essential functioning of the process was due.

It was proved at the trial and was found by the trial Judge and is not controverted by the Circuit Court of Appeals that the process of the respondent after January 7th, 1917, proceeded in all its essential operations by the *beneficial use* of a minute fraction of one per cent. (about one-tenth to two-tenths of one per cent. or less on the ore) of an oil or oily substance (pine oil) that had been used for several years prior to that date in admitted infringement

of the patent, and this was the basis of the finding of the trial Court that defendant employed the process of the patent in suit after that date just as much as it employed the process before that date, used the same elements, in the same combination, in the same way, with the same function, to the same but poorer results. Yet the Circuit Court of Appeals for the Ninth Circuit regarded only the matter of oil saving and disregarded wholly the real process and the factors that did the real work of the process. It did not adopt or apply in determining the issue of infringement those criteria of the invention that this Court applied and announced in the Hyde decision in determining the issue of validity.

On the contrary it adopted and applied "oil-saving" criteria that persisted from its own previous decision in the Hyde case, but such criteria had been discredited and superseded by the reversal of that decision by this Court and the manner of that reversal.

As set forth in the accompanying petition, the decree, although interlocutory in form, finally determines all issues that have been contested herein. It was in all respects final as originally entered, and was altered to its present form because the Circuit Court of Appeals had overlooked defendant's admission of infringement for the period prior to the decision of this Court in the Hyde case. This alteration was effected without altering the opinions of the Court upon the disputed issues. The contention therefore, should it be made, that the writ of certiorari should be denied because the decree in its present form is not in all respects a final decree, has no sound basis as a reason for the denial of the petition at this time.

As to the question of power, that has already been decided in prior cases, *Forsyth* vs. *Hammond*, 166 U. S., 506, *American Co.* vs. *Jacksonville Co.*, 148 U. S., 372, 383, *Denver* vs. *New York Trust Co.*, 229 U. S., 123.

As to the question of propriety, there is in the instant case not only the same variance between the decisions of the House of Lords and of the Circuit Court of Appeals for the Ninth Circuit in fundamental conception of the process in relation to the prior art that formed the basis for the application for the writ in the Hyde case, and the added variance in that same regard between the decisions of the Circuit Court of Appeals for the Third Circuit in the Miami case and the Circuit Court of Appeals for the Ninth Circuit here, but, what is even more important, there is in the instant case such misinterpretation and misapplication of the decision of this Court in the Hyde case as amounts in fact to a non-acceptance of the latter by the lower court and renders the same in effect wholly nugatory. Confusion and uncertainty as to the meaning of the decision of this Court in the Hyde case have been created in a great and widespread industry by the decision of the Circuit Court of Appeals in the instant case, at a time when certainty and uniformity of decision is especially important.

An accounting as to admitted infringement can in no possible way assist this Court in effectuating its decision in the Hyde case and, if conducted on a theory of the invention which is held ultimately to have been fundamentally erroneous, it may not benefit your petitioners, and certainly will not help the public, or conserve the due administration of the law.

In conclusion it is submitted that the Petition for Writ of Certiorari should be granted.

Respectfully submitted,

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Appendix.

ANALYSIS BY QUOTATION OF THE OPINION OF THIS COURT IN THE HYDE CASE (242 U. S., 261).

This Court in the Hyde case held with the District Court and contrary to the Circuit Court of Appeals that the process

> "differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that we are persuaded that it constitutes a new and patentable discovery."

In reaching that conclusion this Court began by pointing out that all kindred prior oil processes

> "speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass —'the pulp'— thus formed so as to separate *the oil*, when *it* became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue." (Italics ours.)

The Court divided the processes of this general character described in prior patents roughly into two classes and said of the first class, or "Surface Flotation Process,"

> "it depends for its usefulness on *the oil* used *being sufficient* to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and *by its buoyancy* to carry them to the surface of the mixture of ore, water and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrate thus obtained into any desired receptacle." (Italics ours.)

It said that the process of the other class, known as the "Metal-Sinking Process,"

> "reverses the action of the Surfact Flotation Process and is illustrated by the Cattermole U. S. Patent No. 777273, in which oil is used to the extent of 4% to 6% to 10% of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water."

The Court then pointed out that the process of the patent in suit

> "as described and practiced, consists in the use of an amount of oil which is 'critical' and minute as compared with the amount used in prior processes 'amounting to a fraction of one per cent. on the ore,' and in so impregnating with air the mass of ore and water used, by agitation—'by beating the air in the mass'—as to cause to rise to the surface of the mass, or pulp, *a froth,* peculiarly coherent and persistent in character, which is composed *of air bubbles with only a trace of oil in them,* which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment." (Italics ours.)

It was at this point that the Court announced its conclusion first quoted above that it is obvious that the process of the patent in suit is not of the Metal-Sinking class and while it may in terms be described as a Surface Flotation Process, yet it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate, that the Court is persuaded that

> "it constitutes a new and patentable discovery."

The Court then referred to the prior processes as requiring

> "the use of so much oil that they were too expensive to be used on lean ores,"

and instancing Froment and Kirby; Froment as

> "little more than a laboratory experiment"

and Kirby

> "though approaching in some respects more nearly to the end attained by the process of the patent in suit"

as finding

> "its preferred application in the use of an amount of oil solution equal to one-fourth to three-fourths in weight of the ore treated, which was prohibitive in cost."

The Court then recited briefly the history of the discovery (clearly for its bearing on the question of invention) saying:

> "The experimeters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid was used. *This froth,* on collection, was found to consist *of air bubbles modified by the presence of the minute amount of oil used* and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly rec-

> ognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, *which air, in bubbles,* attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and *floated* them to the surface." (Italics ours.)

This Court then quoted as not an over statement of fact the following:

> " 'The present invention differs essentially from all previous results. It is true that oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained, before.' "

The Court then said that it was convinced

> "that the small amount of oil used makes it clear that *the lifting force* which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force *is to be found, chiefly in the buoyancy of the air bubbles* introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical." (Italics ours.)

This Court then expressed its agreement with the House of Lords where in speaking of the process Lord Shaw said:

> " 'They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a

> method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid.' "

And Lord Atkinson said:

> " 'In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop, or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water.' "

This Court then referred to the immediate and extensive use made of the process as persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect.

The Court held as untenable

> "the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be *within the scope of the claims*, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. *The composition of ores*

varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment *within the terms of the claims*, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law." (Italics ours.)

As to infringement (where the only contention of the defendant was that the facts had not been proved) all that the Court said was:

"The evidence of infringement is clear."

In conclusion the Court said:

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (*The Barbed Wire Patent*, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to *the results obtained* by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7 and 12, and that the

defendant infringed these claims, but that it is invalid as to claims 9, 10 and 11."* (Italics ours.)

*The difference in phraseology between claims 1, 2, 3, 5, 6, 7 and 12 on the one hand, and claims 9, 10 and 11 on the other hand, *in the matter of the "results" to be "obtained,"* is that in all the claims of the former group it is prescribed that the froth must be formed or constituted *by the oil-coated mineral particles,* whereas in all the claims of the latter group the only prescription is that "a froth," any sort of froth, is to be formed.

Thus claims 1, 2 and 3, say agitate

"until the oil-coated mineral matter forms into a froth";

and claim 12 says agitate

"to cause the oil-coated mineral to form a froth";

and claims 5, 6 and 7 say agitate

"until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith."

Whereas claims 9, 10 and 11 merely say agitate

"to form a froth."

The difference in phraseology between the two groups of claims *in the matter of oil quantity* is as follows.

Claims 5, 6 and 7 specify

"a small proportion of oleic acid amounting to 0.02—0.5 per cent on the ore";

claim 12 specifies

'a fraction of one per cent. of oil on the ore";

claims 1, 2 and 3 specify

"a small proportion of the oily liquid having a preferential affinity for metalliferous matter, (amounting to a fraction of one per cent. on the ore)."

Whereas claims 9, 10 and 11 specify

"a small quantity of oil."

The opinion of this Court in the Hyde case was filed on December 11th, 1916. The mandate was issued on January 13th, 1917, and was filed in the United States District Court for the District of Montana on March 5th, 1917.

On the 28th day of March, 1917, Minerals Separation, Ltd., one of your petitioners and the sole owner then and now of the legal title to the Letters Patent in suit, filed its disclaimer in the United States Patent Office reciting the decision of this Court in the Hyde case and in pursuance thereof disclaiming:

> "From claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore" (R., Vol. 1, p. 61).

The disclaimer was held valid by Judge Bourquin (R., Vol 1, p. 99) and by Judge Morrow (Appendix to Petition, p. 41; R., Vol. p.). Judge Ross' opinion as originally filed found non-infringement and ordered dismissal of the bill without regard to the question raised respecting the sufficiency of the disclaimer or its resultant effect, but in his opinion as corrected the disclaimer was not referred to and affirmance was adjudged as to the admitted infringement. Judge Hunt's opinion does not refer to the disclaimer. Therefore Judge Morrow affirms Judge Bourquin as to the disclaimer and Judges Ross and Hunt do not reverse him as to the disclaimer. Thus both Courts are in agreement as to the legality, sufficiency and timeliness of the disclaimer and the validity of claims 9, 10 and 11 as limited by disclaimer, although the same conflict as to construction of these claims as thus limited exists as to claims 1, 2, 3 and 12.

[redacted]

Supreme Court of the United States

OCTOBER TERM 1916.

No. 990.

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,

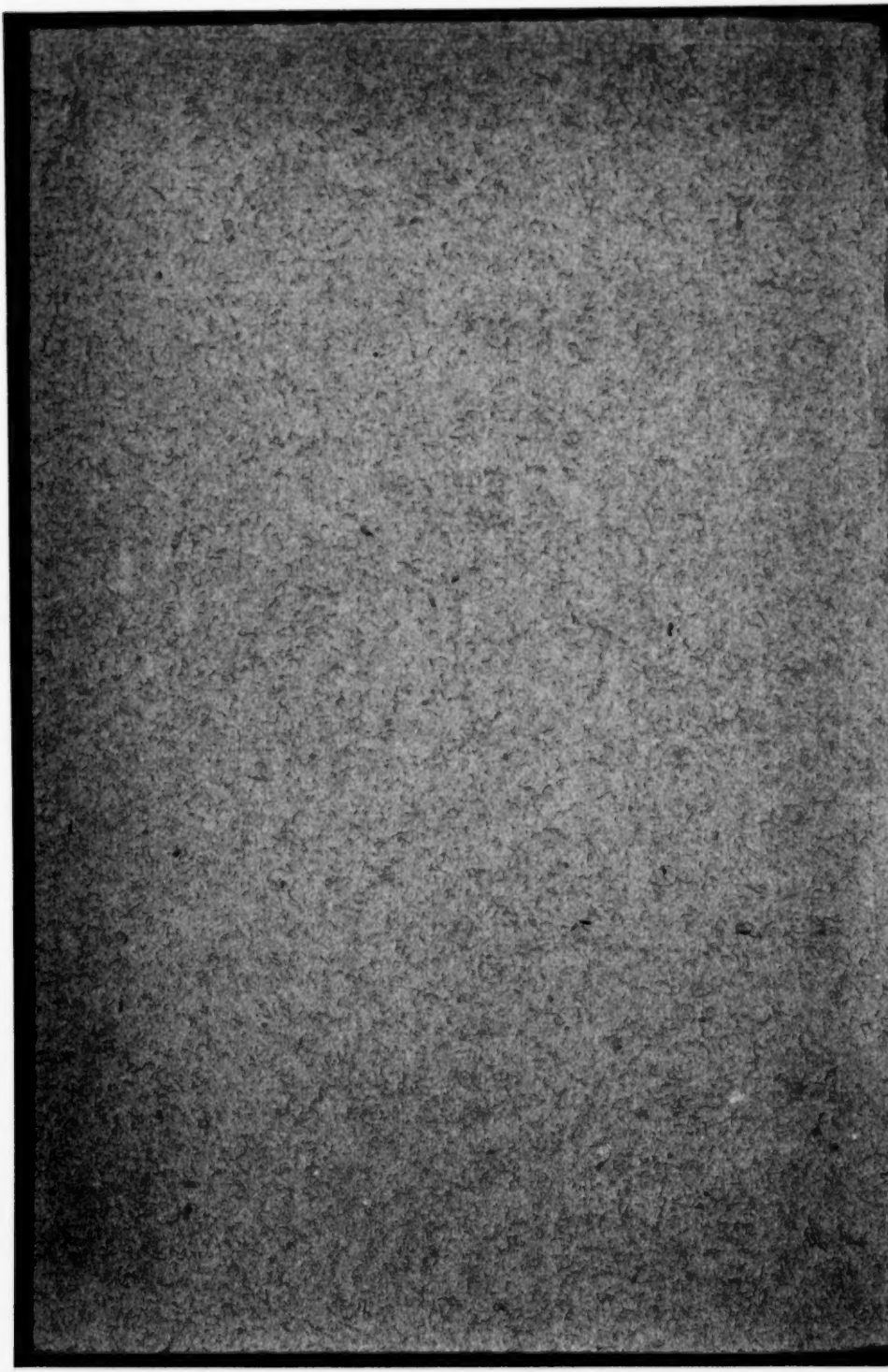
Respondent.

On Petition for a Writ of Certiorari to be addressed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit.

PETITION FOR CERTIORARI AND APPENDED OPINIONS OF THE THREE JUDGES OF THE CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT WITH ANNOTATIONS COMPARING THE SAME WITH THE OPINION OF THIS COURT IN MINERALS SEPARATION LIMITED, vs. HYDE, 242 U. S., 261.

[redacted]

Counsel for Petitioners.



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Supreme Court of the United States

MINERALS SEPARATION, LTD., MINERALS SEPARATION AMERICAN SYNDICATE, LTD., and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,
against
BUTTE & SUPERIOR MINING COMPANY,
Respondent.

PETITION FOR WRIT OF CERTIORARI TO BE ADDRESSED TO THE JUDGES OF THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

To the Supreme Court of the United States.

Your petitioners Minerals Separation Ltd., Minerals Separation American Syndicate, Ltd., and Minerals Separation North American Corporation, respectfully show:

Your petitioners are the owners of the title to and of all rights to profits and damages for infringement of United States Letters Patent No. 835,120 to Sulman Picard and Ballot of November 6, 1906, for a process of Ore Concentration, and this suit is for an injunction and accounting for infringement of that patent.*

*The statement of proceedings preceding the opinion of the Circuit Court of Appeals for the Ninth Circuit outlines the proceedings in the instant case from the commencement of the suit on October 10, 1913, to the argument of the appeal, and is reprinted in the Appendix to this Petition (*infra* p. 21; also R., Vol. VI, p. 3101).

This suit involves the same patent as was passed upon by this Court in the case of Minerals Separation, Limited, and Minerals Separation American Syndicate, Ltd., vs. James M. Hyde, 242 U. S., 261, the defendant and respondent Hyde in that case having initiated for the Butte & Superior Mining Company, defendant and respondent here, the acts of infringement adjudicated in that case.

Butte & Superior Mining Company, respondent here, carried on in its mill by its employees with its own ore and for its own profit, the acts adjudicated by this Court in that suit to be an infringement, the defendant Hyde in that suit having merely initiated and for a time superintended those acts. The respondent here has continued the infringement initiated by Hyde.

In the Hyde suit in this Court the decree of the Circuit Court of Appeals for the Ninth Circuit declaring the patent invalid was reversed and the validity of the patent was affirmed (242 U. S., 261).

In reaching its conclusions in that case this Court found that the process of the patent in suit produced a result never obtained before, and that the advance on the prior art and the resulting froth concentrate obtained, so different from the product of other processes, made it a patentable discovery. This Court found novelty, principally, in the buoyancy of air bubbles (which formed a multitude of air cells) floating the metal particles—in the principle of action and the results obtained by the use of oil within the "critical proportions" set forth in the claims of the patent amounting to a fraction of one per cent. on (relative to) the ore, and affirmed without limitation all of the claims wherein such results and proportions were prescribed.

In the instant case the Circuit Court of Appeals for the Ninth Circuit, interpreting and applying that decision on an issue of infringement, has, on the sole basis of their interpretation of that decision, reversed the holding of infringement made by the District Court.

The Circuit Court of Appeals in the decree as first entered by it in the instant case found against the plaintiff on all issues, reversed the decree of the Court below and ordered a dismissal of the bill. Subsequently and upon having its attention called to the fact that it had overlooked an admitted infringement of five and a half years, it entered an order modifying the decree (*infra*, p. 42), and altered its decree to sustain the bill to the extent of the admitted infringement, thereby in effect ordering an injunction and accounting in respect thereof. Thus a final decree was altered to an interlocutory decree without altering the opinions of the Court upon the disputed issues, and the decision is in fact a final decision upon all the disputed issues, and it denies injunction against the present infringement, and as to the accounting for the admitted infringement it leaves the matter in such condition as may well affect the whole theory and basis of that accounting.

We believe and respectfully submit that the Circuit Court of Appeals has wholly misunderstood and misinterpreted and misapplied the decision of this Court in the Hyde case.

The Circuit Court of Appeals for the Ninth Circuit in its decision in the Hyde case (214 Fed., 100) had held the patent wholly invalid on the finding that there was nothing novel in the process, either in ingredients, manipulation, operation or result, and that the only discovery made was that oil could be saved in an old process and that this was merely a matter of degree, the work of the engineer, and not patentable.

This Court in the Hyde case, as stated, reversed the Circuit Court of Appeals and held the patent valid as for a new process, reaching a result never obtained before, by a novel principle of operation, concluding that

> "this advance on the prior art and the resulting froth concentrate so different from the product of other pro-

> cesses make of it a patentable discovery as new and original as it has proved useful and economical" (242 U. S. 269).

This Court described and classified the processes of the prior art and described and contrasted the process of the patent in suit and defined the novelty of operation and the novelty of result, thereby establishing *criteria* by which to test the presence or absence of the invention.

In the instant case the District Court has applied these criteria in finding infringement.

But the Circuit Court of Appeals for the Ninth Circuit has not.

On the contrary it refers to its own previous opinion with respect of the prior state of the art and the relation of the process in suit thereto and assumes that the conclusions it there expressed, to wit, that all froths are of an essentially like character and that the achievement was merely a saving in oil, still hold good.

The Circuit Court of Appeals overlooks the fact that its conclusions in that regard were reversed by this Court in the Hyde case. It has determined the question of infringement in disregard of and contrary to the *criteria of invention* postulated by this Court. The scope and reasoning of its opinions and the effect of its decision are such as to nullify the decision of this Court in the Hyde case as to the character and value of the invention of the patent in suit, and are in conflict with the findings of fact that were made by this Court in that case and with the reasoning upon which those findings were based.

Because of this fundamental conflict with, and divergence from, the decision of this Court in the Hyde case, the Circuit Court of Appeals in the instant case has erroneously imputed to this Court a decision that the invention and the patent are limited to the use of *one-half of one per cent.* or less of *any* oil or oily substance that

has a preferential affinity for metalliferous matter over gangue.

Two errors of interpretation are here involved, namely:

First, the imputed limitation of the patent to the use of *one-half of one per cent.* of oil or oily substance, and

Second, the imputed extension of the patent to *any* oil or oily substance having a preferential affinity for metalliferous matter over gangue, *whether capable of effectuating the process or not.*

The first error renders the decision of this Court in the Hyde case nugatory as to a substantial portion of the field clearly intended to be covered thereby, because claims 1, 2, 3 and 12, which as to oil proportions specify "a fraction of one per cent." on the ore, were sustained by this Court as valid without limitation and so as to include every fraction of one per cent. which would effectuate the process.

The second error renders the decision of this Court in effect wholly nugatory, because it would permit an unauthorized user of the process to escape the charge of infringement by using the process in every detail (including the small quantity of suitable oil determined as prescribed in the patent and added in the critical proportions required) and simply adding a further quantity of another oil or oily substance which, although incapable of effectuating the process when used alone, would yet not destroy the action of the suitable oil of the process. This is what respondent has done.

The fact that such alien or non-functioning oils could be so used was not proved or known in the Hyde case. It appears in the instant case, however (R., Vol. IV, p.

1941, XQ361; p. 1942, XQ370) that after the testimony in the Hyde case was closed, one of the respondent's employes, experimenting in the laboratory with thousands of different oils, discovered that with respondent's ore certain petroleum oils (although incapable alone of effectuating the process) could be used in admixture with oils and oily substances capable of effectuating the process, without defeating the process, even in such amounts as to make the total mixture of effectual and ineffectual oils one per cent. or slightly more.

Immediately after the decision of this Court in the Hyde case, the respondent, after certain experiments in the mill, added to the critical proportions (one-tenth to two-tenths of one per cent. on the ore) of pine oil, a highly effectual oil of the process and which it had been using in those critical proportions for several years in admitted infringement of the patent in suit, a mixture of fuel oil and kerosene oil, which separately or together were ineffectual to achieve the process, and which were confessedly added for the mere purpose of avoiding the patent in suit. This fuel oil and kerosene oil were added in the treatment of a considerable tonnage of ore, extending over a period of about two months, in such amount as to bring the total oil mixture used to more than one-half of one per cent., and later on to slightly above one per cent. on the ore. The operations constitute the acts of infringement in controversy.

After this addition of fuel oil and kerosene, the process remained identically the same in character, in mode of operation, in the factors that did the work, in the principles of action involved, and in the results obtained. Respondent did not alter the process, but merely impaired it, by the addition of the ineffective weight-making diluent oils, as was proved in evidence and found by the trial Judge and not questioned by the Circuit Court of Appeals.

Nevertheless, wholly upon the basis of the decision imputed to this Court in the Hyde case by the Circuit Court of Appeals, the full Court reversed the District Court, holding non-infringement during the period when one per cent. or more of oil mixture was used and the majority of the Court, going still further, held non-infringement during the period when any amount over one-half of one per cent. of oil mixture was used.

If the principles and matters decided by this Court in the Hyde case are to be maintained, it is necessary that the decision of the Circuit Court of Appeals for the Ninth Circuit in the instant case should be brought here for review since the latter decision not only opposes but nullifies the former in respect thereof.

Because of the persistence of the Circuit Court of Appeals for the Ninth Circuit in the instant case in the errors and mistakes of its own opinion in the Hyde case as to the character of the invention in suit and its relation to the prior art, there is the same variance between the foundations of its decision in the instant case and the decision of the House of Lords (referred to by this Court in its opinion in the Hyde case) that existed between its decision in the Hyde case and that decision in the House of Lords, and the reasons that existed for granting the Petition for Writ of Certiorari in the Hyde case are again present.

And in addition there is the further variance created by the decision of the Circuit Court of Appeals for the Third Circuit in the Miami case (244 Fed., 752), hereinafter referred to, where the broad view of the invention set forth by this Court and by the House of Lords is set forth at large and emphatically.

To state the facts somewhat more in detail the Circuit Court of Appeals for the Ninth Circuit, in its decision in the Hyde case, reviewed the prior art processes and stated its conclusion as to those processes and that of the patent in suit "that the froth in all these processes is the same with the exception that there is less oil * * * in the appellees' froth than in the others" (214 Fed., 106, 107). It held that "the fact that the appellees use a smaller quantity of oil than was used in the prior art is not of itself, and is not claimed by them to be, sufficient to distinguish their process so as to render it patentable. To discover that the desired result may be accomplished with the use of a fraction of one per cent. of oil when formerly a much larger quantity of oil had been used and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. It is a difference of degree and not of kind" (214 Fed., 105).

In reversing that decision this Court held in respect of the process of the patent in suit that "it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate that we are persuaded that it constitutes a new and patentable discovery" (242 U. S., 266). This Court further adopted the statement that the process of the patent in suit "produces a result never obtained before" (*idem*, p. 268) and concludes, as above quoted, "that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical" (*idem*, p. 269).

In the instant case Judge Bourquin, District Judge of Montana, after a trial in open court lasting five weeks, applying the criteria of invention postulated by this Court in the Hyde case, found the defendant guilty of infringement in every instance wherein it had beneficially used

any fraction of one per cent. of oil to produce the mineral froth. This included all operations charged by your petitioners to be infringements.

Judge Bourquin's opinion in the instant case recites the important facts as to the infringing acts of the defendant. It says that defendant, after years of successful operation using at first 5.58 lbs. of oil to the ton of ore (0.28%) and finally 1.43 lbs. (0.07%) in the treatment of about 1,600,000 tons of ore, changed these operations in no other substantial respect than that it added other and ineffective oils so that the aggregate amount of the oil mixture was one per cent. or slightly more.

Judge Bourquin says:

> "Before January 7th, 1917, defendant used only pine oil and about 1.43 lbs. per ton of ore, with excellent results. Since said date it uses a mixture of 20 to 24 pounds of oil per ton of ore [1% to 1.2% on the ore], made up of 18% of pine oil [0.18% to 0.22% on the ore], 12% of kerosene oil and 70% of fuel oil [an aggregate of from 0.82% to 0.98% on the ore of petroleums], with poorer results. * * * As before stated, many oils are ineffective to operate the process, and that is because they have not the quality that contributes to bubble making. What this quality consists of, wherein it lies, does not appear. With these ineffective oils, agitation will not produce froth and so there is no flotation of the metallic particles. * * * Petroleums seem generally ineffective by the evidence of both parties, though some of defendant's witnesses testify to sometime successful experiments with them. Incidentally, there is suspicion that with experiments, as with figures, can be done anything for or against, without impropriety in the operator. Some petroleums are used in limited quantities, but always in combination with a recognized bubble making oil, and only, it is said, for a somewhat bubble stabilizing effect. Defendant's present mixture of oil contains more pine oil on the ore [a maxi-

mum of 0.22% as contrasted with a minimum of 0.07%] than it used alone before January 7th, 1917. The other factors the same, it is obvious the excess petroleums in the mixture are responsible for the poorer results.

"Defendant uses the patent process, uses plaintiffs' invention of ore concentration by air bubble flotation, uses the same elements in the same combination in the same way with the same function to the same but poorer results; and exceeding the patent claims in reference to one ingredient (oil) uselessly, wastefully and injuriously and merely with intent to avoid the letter of the patent, does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process. The excess oil exercises either no function or less efficiently exercises the same function in the same way as the limited oil, and to the same but poorer results. To secure to patentees their invention, the law looks quite through mere devices and forms, to the substance of things. And if in substance the invention is taken, if the thing that does the work is taken, all devices to evade the letter of the patent avail nothing to escape the consequences of infringement" (R., Vol. 1, pp. 101, 102; bracketted insertions ours).

Judge Bourquin also said:

"Patent law is not concerned with the useless, and a valuable result sought is not 'obtained' by but *despite* the use of an excess of an essential ingredient, which excess renders no or ill service. From the evidence it appears the larger part of the oil used by defendant and all in excess of a fraction of 1% on the ore, if not inert, is ineffective, wasted and injurious to the process and results" (R., Vol. 1, p 101, italics Judge Bourquin's).

Additionally it may be noted that the change in defendant's procedure after January 7, 1917, involved first

and for a period of about two months, the addition to the useful mineral-froth-forming oil (pine oil) of such an amount of the ineffective oils (petroleums) as to make the total oil proportion greater than one-half of one per cent. and less than one per cent., and this in the treatment of about 77,000 tons of ore (R., Vol. VI, Def. Exhs. 159 and 161 following p. 2882 marked pp. 5187 and 5193 Thereafter the total oil proportion was in like manner increased to one per cent. or slightly more.

An appeal was taken by the defendant to the Circuit Court of Appeals for the Ninth Circuit and was heard there by Judges Ross, Morrow and Hunt. A majority of the Court, Judges Ross and Hunt (Judge Morrow dissenting) interpreted the opinion of this Court in the Hyde case as confining the patent to the use of one-half of one per cent. or less of oil or oily substance on the ore, and the full court agreed in interpreting the opinion of this Court as expanding the patent to cover the use of any and every oil and oily substance having a preferential affinity for metalliferous matter over gangue, whether the oil or oily substance thus used was useful or useless, beneficial or harmful (Opinion by Judge Ross, *infra*, p. 23, with annotations; also R., Vol. VI, p. 3102; concurring opinion by Judge Hunt, *infra*, p. 32, with annotations; also R., Vol. VI, p. 3107; opinion in part dissenting, by Judge Morrow, *infra*, p. 37 with annotations; also R., Vol. VI, p. 3109).

These opinions were not based upon the independent judgment of these judges as to the question of infringement presented but upon their opinion as to the limitations imposed upon the patent by the decision of this Court in the Hyde case.

Thus the opinion of the Court, by Judge Ross, says:

> "Nothing, it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court than that it did not intend to extend the monop-

> oly of the patent in suit to the use of one per cent. of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellee's 'experimenters' only rose to the dignity of *invention* when they ascertained that the desired results could be and were obtained by the use of five-tenths (½) of one per cent. of oil on the ore, with still better results as the quantity was reduced to the vanishing point at less than one-tenth of one per cent. The quantity of oil that gave birth to the invention—five-tenths (½) of one per cent. on the ore (at which point no more granulation exists)—to the lesser and extreme limit of the minute quantity (less than one-tenth of one per cent.)—at which the desired result ceases, are the 'critical proportions,' 'amounting to *a* (italics ours) fraction of one per cent. on the ore,' to which the appellees' patent is 'confined' by the Supreme Court as we understand its opinion" (*infra* p. 29; R., Vol. VI, p. 3105).

In reaching its conclusion in the instant case as to the imputed limitation of the patent to one-half of one per cent. of oil the majority of the Circuit Court of Appeals for the Ninth Circuit refer to its own previous opinion in respect of the prior state of the art as establishing that the results of the prior art processes and of the process of the patent in suit were identical, except for a difference of degree, and construe the opinion of this Court in the Hyde case as affirming the patentability of the discovery in respect only of a particular degree of saving in oil. They quote this Court's reference to the evidence in the Hyde suit of the birth of the invention, that is, of the incidents at the time of the discovery, when a specific oily liquid (oleic acid) was used with a specific ore (Broken Hill ore) under specific conditions of heat, acidity and agitation, and from it they impute to this Court the implication that, since the phenomena only began to appear at one-half of one per cent. *under the conditions*

then existing, those are the limits of patentability under *all conditions,* and therefore the claims (despite the evident meaning and legal effect of their language) do not protect the patentees excepting within those limits as to *all ores* and *all oils* and *all conditions.* They select from the opinion of this Court in the Hyde case certain phrases in respect of proportions of oil, etc., from which they deduce the conclusion that in holding valid the claims of the patent prescribing the use of oil amounting to a fraction of one per cent. on the ore this Court intended to limit such fraction to one-half of one per cent. or less, and they find confirmation of this understanding of the opinion of this Court by adverting to a colloquy occurring during the argument of the Hyde case between certain members of the Court and counsel for the plaintiff (which related to oleic acid and Broken Hill ore and did not relate to the scope of the claims or to the boundaries of the invention in general), and Judge Hunt finds confirmation also in the details of the particular example described in the patent specification.

Judge Morrow dissented from the view that this Court intended in any way to restrict the claims prescribing "a fraction of one per cent." of oil relative to ore to any particular fraction, and expressed the opinion that on the contrary this Court intended them to be read in their natural meaning as they appear, and intended that the patent should cover the use of oil in any and every fraction of one per cent., so long as the novel results were obtained (*infra,* p. 37; R., Vol. VI, p. 3109). We quote from his opinion as follows:

> "I think the direction of the Supreme Court that 'the patent must be confined to the results obtained by the use of oil within the proportions * * * amounting to a fraction of one per cent. on the ore' means just what it says, and that within such proportions the process described in the patent is held by the

> Supreme Court to be a valid discovery protected by the Specification and Claims numbered 1, 2, 3 and 12. The Supreme Court does not say that the patent must be confined to the oleic acid claims (claims 5, 6 and 7), nor does it say that the other claims of the patent must be confined to the use of oil in the fraction mentioned in those claims. Had the Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one-half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in claims 5, 6 and 7. For what purpose does the Court hold claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions 'amounting to a fraction of one per cent. on the ore'; that is to say upon ores generally" (*infra*, p. 39; Vol. VI, p. 3110).

There is nothing in the opinion of this Court in the Hyde case which in any way restricts the natural meaning of the language employed in the claims which it held valid. On the contrary it distinctly says that the patent reaches out to "the terms of the claims" (242 U. S., 271). It did confine the whole patent to what it found were the novel results of the process by holding invalid certain other claims that were not confined to those results, but it said that "variation of treatment must be within the scope of the claims" (*idem*, 270) and that "range of treatment within the terms of the claims" (*idem*. 271) would be within the scope of the patent.

The opinion of this Court in the Hyde case found that the discovery was of a new process obtaining results that had never been obtained before and that it was patentable. The disagreement with the decision of the Circuit Court of Appeals for the Ninth Circuit then under review was not, of course, as to the principle of law that

a mere difference of degree is not patentable, for that principle is well settled. The fundamental difference and disagreement was in respect of the prior state of the art and the character of the invention of the process in suit. The novelty of the operation and of the results was pointed out both by contrast and by definition. The fact that "the composition of ores varies infinitely" was pointed out. The fact that "when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary to obtain the best results" (242 U. S., 271), was stated. So far from limiting the natural meaning of the language of those claims which specified "a fraction of one per cent.," this Court quoted that language from the claims and adjudged the validity of all claims which employed that language. It also adjudged the validity of the narrower claims, limited to oleic acid, wherein the upper limit specified of oleic acid was one-half of one per cent. on the ore. In adjudging the validity of claims 1, 2, 3 and 12, which specified "a fraction of one per cent." of oil, it made no statement whatsoever limiting or narrowing their scope as to oil quantity to the scope of claims 5, 6 and 7, which specified an upper limit of one-half of one per cent. of oleic acid. It said that "variation of treatment must be within the scope of the claims" (242 U. S., 270), but it did not limit the scope of the claims which it adjudged to be valid to anything less than the natural meaning of the words of these claims themselves.

Moreover there is nothing in the opinion of this Court in the Hyde case which expands the patent and its claims to cover the use of any and every oil or oily substance having a preferential affinity for metalliferous matter over gangue, whether capable of effectuating the process or not. On the contrary this Court distinctly says that the patent must be confined to such processes as obtain the results it

specifies—an exclusion that applies as much to an oil that because of its quality cannot obtain those results as to an oil that because of its excessive quantity cannot obtain those results.

These misinterpretations and misapplications in the instant case of the opinion of this Court in the Hyde case result in nullifying the value of a patent adjudged to be valid by this Court, by opening the door to infringers who merely disguise their operations by adding a useless diluent to the critical proportions of oil effectuating the process. They disturb settled principles of law and confuse the state of the law, not only in the widespread litigation under the patent here in suit, and in the relations to it of a great and important industry, but also in respect of other litigations wherein similar principles of law are applicable.

The circumstances of this suit make it closely analogous to those cases in which a court of subordinate jurisdiction has not properly carried out the mandate of a superior Court in the same case. While the defendant in the present case may not technically be in privity with the defendant in the Hyde case, the patent is the same, the process is the same, the defendant here employed the defendant there and participated in the act of infringement there and is sued here for that participation as well as for its continuance of the infringment; and we respectfully submit that the Circuit Court of Appeals of the Ninth Circuit has not in fact carried out the decision of this Court in the Hyde case, but has, on the contrary, perverted its meaning and nullified its effect by limiting all the claims of the patent to the use of one-half of one per cent. of oil on the ore, and by not limiting them to oil or oily substances that will do the work of the process in the way described in the specification and recited in the claims and set out in the opinion of this Court.

The numerous decisions wherein the process here in suit has been considered may be tabulated as follows:

British Ore Concentration Syndicate, Ltd., vs. Minerals Separation, Ltd., 25 R. P. C., 741, High Court of Justice, Chancery Division; affirmed after intermediate reversal in the Court of Appeals by the House of Lords in

Minerals Separation, Ltd., vs. British Ore Concentration Syndicate, Ltd., 27 R. P. C., 33.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, Ltd., Supreme Court New South Wales, 31 R. P. C., 216, 217.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, 31 R. P. C., 206, Privy Council British Empire.

Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956 (D. C. Montana).

Hyde vs. Minerals Separation, Ltd., 214 Fed., 100 (C. C. A., 9th Circuit).

Minerals Separation, Ltd., vs. Hyde, 242 U. S., 261.

Minerals Separation, Ltd., vs. Miami Copper Co., 237 Fed., 609 (D. C. Delaware).

Minerals Separation, Ltd., vs. Miami Copper Co., 244 Fed., 752 (C. C. A., 3rd Circ., including dissenting opinion by Judge Buffington, p. 775).

Minerals Separation, Ltd., et al., vs. Butte & Superior Mining Co., 245 Fed., 577 (the present case, D. C. Montana).

Butte & Superior Mining Co. vs. Minerals Separation, Ltd., et al., not yet reported (the present case, C. C. A., 9th Circuit; *infra,* p. 21; R., Vol. VI, p. 3101), on which were entered the decree of May 13, 1918 (R., Vol. VI, p. 3112), and the order modifying decree of May 20, 1918 infra, p. 42; R., Vol. VI, p. 3113).

Of the above judicial judgments and opinions, all of the British cases above cited are in entire harmony with the

opinion of this Court. Additionally the opinions of all the trial judges in this country are in harmony with the opinion of this Court—Judge Bradford's opinion in the Miami case, following a nine weeks' trial in open court and rendered just prior to the argument of the Hyde case in this Court, and Judge Bourquin's opinion in the instant case, following a five weeks trial in open court.

Two Circuit Courts of Appeal, those of the Third and Ninth Circuits, have applied the decision of this Court in the Hyde case. The decision of the Ninth Circuit is the one that we seek to bring here for review and has heretofore been dealt with, the judges disagreeing two to one on the matter of limitation to one-half of one per cent. of oil. In the Third Circuit (Minerals Separation, Ltd., vs. Miami Copper Company, 244 Fed., 752), all of the judges expressed the broad view of the novelty and character of the process that this Court expressed and unquestioningly assumed that the claims of the patent protect the patentees in respect of the use of oil in any and every fraction of one per cent. of oil on the ore where the novel result is obtained. This point was not directly involved in the suit, but the assumption, as above stated, appears in the two opinions filed. That Court disagreed two to one upon another matter involved in the decision of this Court in respect to this patent, which need not at this time be considered.

A great, important and widespread industry, that of mining and producing zinc, copper, lead, silver, gold and other metals, is now in uncertainty by reason of the misinterpretation and misapplication in the instant case of the decision of this Court in the Hyde case, as to the true meaning of that decision as applicable to its daily operations. So also the varying interpretations of this decision in the Third Circuit have introduced a further element of uncertainty in the mining community which could be clarified by a review of the instant case.

Your petitioners are advised and believe and therefore assert that the decree of the Circuit Court of Appeals for the Ninth Circuit herein is erroneous, and that the matters and questions involved in said decision, being but variations of the same matters and questions involved in the Hyde case, are of such grave and general importance that this Honorable Court should require the said cause to be certified to it for its review and determination, in conformity with the provisions of the Act of Congress in such cases made and provided, particularly as the said decision of the Circuit Court of Appeals for the Ninth Circuit is expressly based upon an erroneous interpretation of the decision of this Court in the Hyde case which renders that decision nugatory.

WHEREFORE because of the gravity and importance of the questions involved and in the interest of uniformity of decision, and to make practically effective the decision of this Court in the Hyde case, your petitioners respectfully pray that a writ of certiorari may be issued out of and under the seal of this Court, directed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit, commanding them and each of them to certify and send to this Court on a day certain to be therein designated, a full and complete transcript of the record and of the proceedings of the said Circuit Court of Appeals in the case lately depending therein entitled "Butte & Superior Mining Company, Appellant, *versus* Minerals Separation, Limited, Minerals Separation American Syndicate, Limited, and Minerals Separation North American Corporation, Appellees, No. 3081" to the end that the decree of said Circuit Court of Appeals in said case may be reviewed as provided in Section 6 of the Act of Congress entitled "An Act to establish Circuit Courts of Appeals and to define and regulate in certain cases the jurisdiction of the Courts of the United States, and for

other purposes," approved March 3, 1891, and may be reversed by this Honorable Court to the extent that it reverses or modifies the decree of the District Court, and that your petitioners may have such other and further relief or remedy in the premises as to this Court may seem appropriate and in conformity with the said Act.

And your petitioners will ever pray.

MINERALS SEPARATION, LIMITED,
By JOHN BALLOT,
Chairman and Director.

MINERALS SEPARATION
AMERICAN SYNDICATE, LIMITED,
By JOHN BALLOT,
Chairman and Director.

MINERALS SEPARATION
NORTH AMERICAN CORPORATION,
By JOHN BALLOT,
President.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
ODELL W. MCCONNELL,
Counsel for Petitioners.

Appendix.

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,

FOR THE NINTH CIRCUIT.

BUTTE & SUPERIOR MINING COMPANY, Appellant, vs. MINERALS SEPARATION LTD., et. al., Appellees.	No. 3081.

OPINIONS.

This is an appeal from the decree of the United States District Court for the District of Montana, sustaining Letters Patent No. 835,120, issued to Sulman, Picard and Ballot on November 6, 1906, for a process of ore concentration, and adjudging the appellant herein to have infringed the same.

The appellees, two British corporations and one domestic corporation, are the legal owners of the title to the patent in suit, and of the rights to profits and damages for infringement thereof. The appellant is a domestic corporation, doing business at Butte, Montana, where the acts of infringement complained of were committed.

The suit was commenced on October 10, 1913, and a preliminary injunction sought. At the hearing on the motion for a preliminary injunction the pleadings and proceedings in the suit of Minerals Separation, Limited, et al., vs. James M. Hyde, in the United States District Court for the District of Montana, were offered and received in evidence, and are a part of the record herein.

That suit was upon the same patent and the issues were substantially the same as in the present case.

The answer of the defendant set up the defense of anticipation, and denied infringement. While the cause was at issue, but before trial on the merits, the Supreme Court of the United States rendered its decision in the Hyde case (242 U. S. 261), holding Claims 1, 2, 3, 5, 6, 7, and 12 of the patent to be valid, and Claims 9, 10, and 11 to be invalid.

The plaintiffs filed a supplemental and amended bill on May 1, 1917, during the trial of the case on the merits, pleading a disclaimer filed by them on March 28, 1917, and charging continued infringement of Claims 9, 10, and 11 of the patent, as limited by said disclaimer, and of the remaining claims.

To the plaintiffs' supplemental and amended bill of complaint defendant filed its answer on May 4, 1917, denying infringement and the validity of the patent by reason of lack of novelty and invention; alleged, further, that the patent had become wholly void and invalid by reason of the unreasonable neglect and delay of the plaintiffs to file a proper or any disclaimer in writing to Claims 9, 10, and 11, held to be invalid by the Supreme Court in the Hyde case; alleged, also, an estoppel against the claim of infringement by the use by the defendant of an amount of oil exceeding five-tenths of one per cent. on the weight of the ore, basing this defense upon a statement made by one of plaintiffs' counsel in the Supreme Court of the United States in the Hyde case, that the invention described in the patent was not reached or practiced until the amount of oil fell to or below five-tenths of one per cent. on the weight of ore treated by the process.

Upon the issues thus presented voluminous testimony was taken upon all the questions involved, which, as stated, were substantially the issues in the Hyde case,

restated and reconsidered by the lower court in the present case.

The court thereupon entered a decree in favor of the plaintiffs, in accordance with the conclusions of the opinion, holding that the plaintiffs were the owners of the patent in suit; that the processes employed by the defendant both before and after the filing of the bill of complaint, to and including January 7, 1917, embodied the invention of the patent and infringed Claims 1, 2, 3, 5, 6, 7, and 12 thereof, and Claims 9, 10, and 11, as limited by said disclaimer; and that the processes employed by the defendant from the 7th day of January, 1917, down to and through the time of the trial, embodied the invention of the patent and infringed Claims 1, 2, 3, and 12 thereof, and Claims 9, 10, and 11, as limited by the said disclaimer. The decree granted a permanent injunction against the further use of such process by defendant, and directed that an accounting be had for the assessment of damages accruing from such use. From that decree the defendant has appealed to this court.

Before—ROSS, MORROW and HUNT, Circuit Judges.

ROSS, Circuit Judge: Notwithstanding the strenuous contentions on both sides of this litigation, the very elaborate preparations, and able arguments of many distinguished counsel, we can but regard the case as a very plain one.

To start with, the law is too well established to require discussion or the citation of authorities, that the patentees' rights under a patent are governed and limited by its valid claims—its specifications being referred to

only as illustrative of the true meaning of the claims. It is equally well settled law that the mere result of an invention is not patentable; nor is froth, or scum, or pine oil, or any other kind of oil, or oleic acid, patentable as such.

In their specifications the patentees of the patent in suit declare that their invention

> "relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like, from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue";

but of the claims of their patent adjudged by the court below to have been infringed by the appellant, not one specifies any particular kind of oil,* although the fifth and sixth specify as one of their constituents

> "a small proportion of oleic acid [which is an acid existing in most fats in combination with Glycoral], amounting to 0.2-0.5 per cent. on the ore,"

and we do not understand it to be contended that the appellant uses any oleic acid in its process.**

*While it is true that no claim (except the oleic acid claims 5, 6 and 7) specifies any particular oil or oily liquid by name, the claims very particularly specify the oil or oily liquid by function. Judge Ross curiously overlooks the fact that each and every claim (as well as the specification) in one form of words or another (claims 9, 10 and 11 by disclaimer) specifies that "the oil-coated mineral matter forms into a froth." This requires an oil that will obtain this result—that is, a mineral-froth-forming oil. If it will not do that, it is not the oil of the patent—at least not for that ore and for those conditions.

**This is true only of the latter part of the period of infringement. The defendant carried on in its mill by its employees with its ore and for its profit the act of infringement adjudicated by this Court in the Hyde suit wherein oleic acid was used as the oily liquid within the proportions specified in the most closely limited claims. These claims 5, 6 and 7, were adjudicated by this Court to be infringed by this act. All of these claims specify oleic acid as the oily liquid within the proportions quoted by Judge Ross, one-fiftieth of one per cent. to one-half of one per cent., inclusive, on (relative to) the ore. The defendant at bar continued to use

It is not denied that at the time of the invention in question the affinity of oil for the metalliferous portion of powdered ore, when mixed with water, was well known, as well as the further fact that the agitation of such a mixture with, as well as without, the addition of acid, would carry the metalliferous portions to the surface of the mixture and the gangue to the bottom; certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this Court when this patent was last under consideration here and when the whole patent was by this Court held void as lacking invention (214 Fed., 100).*

That judgment was, it is true, reversed by the Supreme Court (242 U. S., 261). In doing so, however, the Supreme Court held invalid claims 9, 10 and 11 of the patent, each of which claims was for "a small quantity of oil."

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oleic acid as the only oily liquid of the process from August, 1911, until about June, 1913 (Stip., R. Vol. III, p. 1389; also Vol. IV, p. 1964, XQ442), and then used a mixture of oleic acid and pine oil from June, 1913, until about December, 1914 (R., Vol. IV, p. 1964, XQs 447, 448).

Oleic acid, although not chemically an oil, but a fatty acid, has all the physical characteristics of an oil. It is in fact an oily liquid having a preferential affinity for metalliferous matter over gangue, and is an equivalent of an oil, as was adjudicated by this Court in the Hyde case in finding that claim 12, which simply says "oil," was infringed, as well as claims 1, 2 and 3, which specify "an oily liquid having a preferential affinity for metalliferous matter," and claims 5, 6 and 7, which specify oleic acid.

*This Court, in reversing the Ninth Circuit Court of Appeals in the Hyde case, destroyed that opinion as authority on the disclosures of the prior art. This Court said that the prior art disclosed processes in all of which *oil*, when impregnated or loaded with metal particles, was separated from the gangue, either by its buoyancy floating them to the surface or by its adhesiveness forming them into granules which sank. This Court said in substance that the process in suit differed from these prior disclosures in that it chiefly utilized the buoyancy of air, and "differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate, that we are persuaded it constitutes a new and patentable discovery." The Ninth Circuit Court of Appeals, in the opinion in the Hyde case referred to by Judge Ross as authority, said that all of these processes, those floating by oil and those sinking by oil, were substantially the same in kind as the process in suit, depending upon air flotation, with the single exception of the Elmore oil-buoyancy process. This Court said the process in suit was new in kind. The Ninth Circuit Court of Appeals said in its former decision that it was new only in degree, and persists in that view in the instant case notwithstanding reversal of that finding by this Court.

So that it is plain the appellees are not entitled to be protected in the use of "a small quantity of oil" of any kind, which, as is obvious, is a wholly indefinite quantity.

In holding claims Nos. 1, 2, 3, 5, 6, 7 and 12 of the patent valid to the extent that it did, the Supreme Court, after pointing out in its opinion that there were many investigators at work in the field to which the process in suit related when the patentees came into it, and that it was while engaged in study of prior kindred processes that their discovery was made, said:

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (the former patents having used so much oil as to make its cost prohibitive—our observation; the barbed wire patent, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

Amounting to *a* fraction of one per cent. on the ore is very far from saying amounting to *every* fraction of one per cent. on the ore; *a* fraction is one thing, *every* fraction is a very different thing. It is obvious, we think, that if the Supreme Court had meant to extend the scope of claims 1, 2, 3, 5, 6, 7 and 12 of the patent to *one per cent.* of oil on the ore, as is here contended by the appellees,* it would not have said anything about any *fraction* of one per cent.—certainly there would have been no necessity for

*Appellees' (plaintiffs') contention was and is that when this Court quoted the words "amounting to a fraction of one per cent. on the ore" from claims 1, 2 and 3, and adjudged the validity of these claims and of claim 12 using similar language, it affirmatively held that these claims were valid to the full extent of their terms, and as to oil quantity covered every fraction of one per cent. of useful oil which would perform the new functions and produce the new results characterizing the invention.

doing so, and certainly the use of such specific language as it employed without a purpose cannot be justly imputed to that great tribunal.

That the "critical proportions" "amounting to a fraction of one per cent. on the ore," so protected by the Supreme Court in its decision does not include *every* fraction of one per cent. on the ore is, we think, very clearly shown by the same opinion where, after describing the prior state of the art, the Court said:

> "Into this field of investigation at this stage of its development came the patentees of the patent in suit. They were experienced metallurgists of London, of inventive genius and with financial resources, and they entered upon an investigation of the processes of oil concentration of ores which was continued through several years, and consisted of a very extended series of experiments in which the quantities of oil, of water and of acid used and the extent and character of the agitation of the mass under treatment resorted to, were varied to an almost unparalleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effect on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid

was used. This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface. The extent of the agitation of the mass had been increased as the experiments proceeded until the 'series of Gabbett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,100 revolutions per minute.'

"A careful consideration of the record in this case convinces us that the facts with respect to the process of the patent in suit are not overstated by the plaintiffs' witness, Adolf Liebmann, an expert of learning and experience, when he says in substance:

'The present invention differs essentially from all previous results. It is true that oil is one of the substances used, but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained before. The minerals are obtained in a froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals embedded in such manner that they form a complete surface all over the bubbles. A remarkable fact with regard to this froth is that, although the very slight and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for twenty-four hours without any change having taken place. The simplicity of the operation, as compared with the prior at-

tempts, is startling. All that has to be done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from two and one-half to ten minutes and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore.'

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical."

Nothing it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court, than that it did not intend to extend the monopoly of the patent in suit to the use of one per cent. of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellee's "experimenters" only rose to the dignity of *invention* when they ascertained that the desired results* could be and were obtained by

*Here persists the erroneous idea of the Circuit Court of Appeals of the Ninth Circuit in the Hyde case that the "desired results" were old and well known and had often been obtained before, with the erroneous corollaries that this (the Supreme) Court had, in the Hyde case, merely decided that the ascertainment by Sulman, Picard and Ballot that these old and "desired results" could be obtained by a smaller quantity of oil than ever before, constituted patentable invention, and that this ascertainment of "the smallest quantity of oil that would produce the desired result" (Hyde vs. Minerals Separation, 214 Fed., 109), "rose to the dignity of invention" when the oil quantities fell to one-half of one per cent. on the ore.

the use of five-tenths (½) of one per cent. of oil on the ore, with still better results as the quantity was reduced to the vanishing point at less than one-tenth of one per cent. The quantity of oil that gave birth to the invention —five-tenths (½) of one per cent. on the ore (at which point no more granulation exist.)— to the lesser and extreme limit of the minute quantity (less than one-tenth of one per cent.)—at which the desired result ceases, are the "critical proportions," "amounting to *a* (italics ours) fraction of one per cent. on the ore," to which the appellees' patent is "confined" by the Supreme Court as we understand its opinion.*

And that is just what appears from the present record was the contention of the present appellees before the Supreme Court on the argument of their appeal from the judgment of this Court holding that there was *no invention* in what they did. For it is undisputed that on the argument of that appeal this colloquy occurred between two of the justices and two of the attorneys for the then appellants and the present appellees:

> "Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.
>
> "Mr. Kenyon: At about one-half of one per cent. of oil.
>
> "Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

*The birth of the invention, as described by this Court, occurred while testing oleic acid with Broken Hill ore. With that oily liquid and that ore and under the other conditions present the invention appeared when the oil proportion was reduced to one-half of one per cent. on the ore. We do not understand, however, that this Court, in describing what actually took place at the birth of the invention, intended thereby to confine the invention, as to every oily liquid and every ore and every condition, to the use of one-half of one per cent. or less of oil to ore, especially as this Court specifically referred to the fact that "the composition of ores varies infinitely, each one presenting its special problem" and held to be within the law the statement of the specification that "when different ores are treated preliminary tests must be made to determine the amount of oil," etc., provided only that "such variation of treatment must be within the scope of the claims."

"Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct—

"Mr. Justice McReynolds: I want to know when your invention came into existence.

"Mr. Kenyon: This invention was not reached, I should say from those figures, until about 0.5, that is one-half of one per cent. of oil was reached.

"Mr. Justice McReynolds: At one per cent. you had no invention?

"Mr. Kenyon: No.

"Mr. Justice McReynolds: At one-half of one per cent. did you have invention?

"Mr. Kenyon: It began to come, remote, but it began to come. At 0.3 of one per cent. the float vastly increased, at 0.1 of one per cent. the float again vastly increased.

"Mr. Justice McReynolds: When this float is more than one-half of one per cent. of oil it does not infringe?

"Mr. Kenyon: It does not infringe.

"Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8% or perhaps more, of oil would give the same result, with increased agitation?

"Mr. Williams: Absolutely no.

"Mr. Kenyon: It would not.

"Mr. Justice Pitney: I understood him to say so yesterday, and I supposed there was something in the record to justify it.

"Mr. Kenyon: Nothing; that will be a part of my argument."*

It results from the views above expressed and from the similar ones expressed in the concurring opinion of Judge Hunt, that the decree appealed from must be and is reversed and the case remanded with directions to the court below to so modify its decree as to accord with the opin-

*The oral arguments from which this colloquy was taken were privately printed by the parties. This colloquy related wholly to oleic acid and Broken Hill ore, and did not relate to the scope of the claims or to the boundaries of the invention in general.

ions of the majority of this Court—the appellant to recover its costs on this appeal.**

HUNT, Judge, *concurring.* I will briefly state the ground upon which my concurrence rests.

The Supreme Court in sustaining the claims carefully noted those which were limited to a fraction of one per cent. and the decision explicitly confined the patent to the results obtained by the use of oil within the proportions often described in the testimony and in the claims.

Claims 1, 2 and 3 use the language amounting to a fraction of one per cent. on the ore.

Claims 5, 6 and 7 express amounts percentages on the ore.

Claim 12 uses the words of limitation amounting to a fraction of one per cent. of oil on the ore.

Claims 9, 10 and 11 make no reference to a fraction of one per cent. but do contain the words " a small quantity of oil."

The essence of the invention was in the use of this extremely small fraction of one per cent., and the Supreme

---

**In the opinion as originally filed this paragraph did not appear and in its place appeared the following:

"Inasmuch as it appears without dispute that the appellant company has never used in its process any oil in quantity as small as one-half of one per cent., it results from the views above expressed that the judgment must be reversed and the case remanded with directions to the court below to dismiss the bill at the complainants' costs, without regard to the question raised respecting the sufficiency of the disclaimer filed by the appellees company or to its resultant effect.

It is so ordered."

This was corrected to its present form after defendant's counsel had called the attention of the Court to defendant's admission that until January 7, 1917, it had used oil in quantity not greater than one-half of one per cent. and had suggested modification of the Court's opinion. Thereupon the order modifying decree (*infra*, p. 42, R., Vol. VI, p. 3113), was entered and the opinion and decree previously filed were corrected to their present form. Originally the decree directed final dismissal of bill. Now it finally adjudicates infringement from August 11, 1913, to January 7, 1917, and non-infringement thereafter, and orders an accounting for five and one-half years of infringement, and a permanent injunction pursuant to the decree. Nothing is left for determination except the amount of profits or damages to be awarded to plaintiff on the limited construction which the patent has received.

Court, while sustaining the fraction of one per cent. claims held invalid the small quantity claims, 9, 10, 11, because they were too broad. No monopoly could be given on the use of a small quantity of oil, for that was old. It was new, however, to avoid the use of larger quantities.* The patent must be confined to the use of critical proportions.

Now, keeping in mind that by the decision the court has limited the invention to the critical proportions often described in the testimony and in the claims, we naturally ask: What are the critical proportions described in the specifications? Page 1, line 79, of the specification says:

> "To this is added a very small proportion of oleic acid (say from 0.02 per cent. to 0.5 per cent. on the weight of the ore),"

*Here Judge Hunt agrees with Judge Ross in the assumption that the Circuit Court of Appeals in the Hyde case correctly decided that the results of the use of small and larger quantities of oil were identical; that the only thing which distinguished the process of the patent in suit from prior art processes was the avoidance of the use of the larger quantities of oil that were used in such prior art processes, and that the mistake made by the Circuit Court of Appeals in that decision, which was corrected by this Court in its reversing judgment, was a holding that this reduction in degree in one of the elements used in prior art processes to produce identical results was not patentable.

He assumes that this Court agreed with the Circuit Court of Appeals in respect of the prior art processes and the results attained thereby, and disagreed with it as to the patentability of a reduction in degree.

We respectfully submit that this assumption and decision of Judge Hunt are directly opposed to the decision of this Court in the Hyde case. This Court with entire clearness and so explicitly as to defy successful misconstruction, decided that the novelty of the process in suit was the different results achieved by it from the results achieved by any process of the prior art, and therefore that it was not a matter of degree in the amount of oil used, but was a matter in respect of the effect thereof and the results achieved thereby. In other words it decided the exact contrary of what the Circuit Court of Appeals had decided on this controlling point in the case.

This Court found a novel discovery in the results obtained by the use of oil within the limits of the claims of the patent, and affirmed the patent for that reason. It is inconceivable that it should have found novelty and patentability if it had agreed with the Circuit Court of Appeals that all that the patentees had discovered was the way to produce the old results by the old means but with a reduction in the amount of one of the materials used in the old processes. And yet it is respectfully submitted that this is just the meaning which Judge Hunt attributes to this Court's opinion in the Hyde case and upon which he bases his opinion in the instant case.

and on line 96 we have:

> "The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under 0.1 per cent. of the ore; but this proportion has been found suitable and economical."*

We thus have given to us one-half of one per cent. or less as the critical proportion described. Preferably one-tenth of one per cent. is to be used.

We also ask: What is the evidence wherein there is often described the "critical proportion"? A summary of it is that it is very nearly one-tenth of one per cent. or two-tenths of one per cent. as may be required for particular ore. All through the evidence it appears that minute and critical amounts of oil are to be used as necessary to make the process successful. From one pound of oil to the ton of ore (five hundredths of one per cent.) to four pounds per ton (two-tenths of one per cent.) were the limits in practical work as stated by witnesses.**

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*The part of the specification from which these quotations are taken commences with this statement, "The following is *an example* of the application of this invention to the concentration of *a particular ore*" (Spec., p. 1, lines 70-72, italics ours), and describes the application of the invention, with oleic acid as the oily substance, under described conditions, to Broken Hill ore.

**It is true that with the ores and the oils used by the licensees and infringer in the Hyde case the limits were as stated. But we submit that any inference therefrom that this Court intended to restrict the patent to these limits or to any other limits than those within the terms of the claims is entirely unjustified and unwarranted. The facts that a certain amount of a particular oil will produce the result, that a larger amount of a different oil would be necessary to produce the same result, that larger amounts of the same oils would be required by other ores, are undoubtedly true but immaterial in the matter of construction of the patent. This Court clearly perceived and stated this by saying: "The composition of ores varies infinitely"; "when different ores are treated preliminary tests must be made to determine the amount of oil," etc.; "such variation of treatment must be within the scope of the claims"; "range of treatment within the terms of the claims" is within the scope of the patent.

Again when counsel had the colloquy (quoted in the opinion of Judge Ross) with the Supreme Court, the guiding thought evident in the mind of the inquiring justices was to stamp precision upon the point when *invention in the process* began to appear.* With apparent definite purpose of meeting the interrogatories plaintiff told the court that "invention" began to come when in the descending uses of percentages of oil as small a quantity as five-tenths of one per cent. was used, and was first present when three and two-tenths of one per cent. was used. Of course a court should cautiously consider a response often quickly made by counsel in answer to questions put from the bench lest an injustice may follow by attaching undue weight to an isolated argumentative answer, but in this matter we are earnestly trying to gather the scope and accurate meaning of the expressed thought of the court. We may therefore refer to the fact that the exact position of the plaintiff as to the invention was called for not once but twice, not generally nor indirectly, but positively, simply and unequivocally. Hence in the controversy as to the true interpretation of the opinion the questions put and answers given may be fairly resorted to, not as conclusive at all but as aids toward a better understanding of the statement of the limitations of the claims of the patent and of the definition of the invention included in its language.

Nor do I think there is ground for saying that discrimination was had between known oils, whether vegetable, mineral or animal. To oily liquids which have a "preferential affinity to metalliferous matter" must the plaintiffs be held, and in using kerosene or fuel oil defendants are but employing oils which the patents author-

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*The whole colloquy, as noted under Judge Ross' opinion, related to a particular example—the application of the invention, with oleic acid as the oily liquid, under described conditions, to Broken Hill ore.

ize the use of,* and when defendants use proportions beyond the critical ones of oil, not oleic acid, but other oils, they are not infringing. Oils doubtless vary in being adaptable for use. Some will probably secure more froth than others, and oil formulae may in their ingredients depend upon the particular ore to be treated and upon the economic relationship to the problem under solution. But the froth developed in using the minute quantities of oil is, I think, essentially of a character like the froth shown when different quantities of oil are used**—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this.*

*This changes a statement of scope to a guarantee of the usefulness of everything within that scope, in contradiction of the statement of the specification, approved by this Court, that preliminary tests are necessary "to determine which oily substance yields the proportion of froth or scum desired" (Spec., pat. in suit, page 1, lines 67-69). The specification gives a single example of "an oily liquid having a preferential affinity for metalliferous matter," to wit, oleic acid, and describes its application, under certain conditions, to Broken Hill ore, and the metallurgist is directed to determine by tests the application of the invention to other ores—of different oils or oily liquids to different ores. The patent only authorizes the use of such oils or oily liquids as are found to be useful in the process, and *cautions the metallurgist* that in dealing with the infinity of ores and the infinity of oils and oily liquids he must make preliminary tests to determine usefulness.

The specification describes the air-lift and the metal-carrying air-froth that follow agitation where the oily substance is oleic acid and give this as an example of the invention. And all the claims specify and require that the oil-coated mineral matter form into a froth (claims 9, 10 and 11 by disclaimer). If the oil or oily substance used is such that this operation will not proceed and this result cannot be obtained it is not the oil of the patent. Indeed this Court held explicitly in the Hyde case that the patent must be confined to these results.

**Judge Hunt is here reasserting the conclusion expressed by his Court in the Hyde case that all quantities of oil produce essentially the same froth, notwithstanding the wholly different conclusion plainly stated by this Court in reversing that decision.

*Judge Hunt is here expressing an opinion which would require the skill of a specially trained metallurgist, and in any event his opinion is in contradiction of the proved facts of the case. His statement that all froths look alike to him is not surprising but is irrelevant. It is a large fact of the case, indubitably proved, that the kerosene and fuel oil used by defendant are not useful mineral-froth-forming oils in the process in suit with defendant's ore or any ore with which they are known to have been tested in practical operations.

In the Cattermole process the froth was held to be distinguishable from the froth produced in the patented process of the critical proportion of oil by the fact that certain remarkable and great results come from the use of the critical proportion which were not obtained when the quantity used in the Cattermole process was employed.**

By using the critical proportion of oil as defined, patentees get the maximum froth. They have discovered a process—not a froth—and the process is limited to the use of oil in the specified critical proportion.

The sequel of these views is that inasmuch as defendants keep out of the limits made for the plaintiff by the decision of the Supreme Court by using more than the critical proportion they do not use plaintiffs' process.

MORROW, Circuit Judge, *concurring in part and dissenting in part:*

I concur in the opinion of the majority of the court that the decree should be reversed, but I do not concur in the direction that the bill be dismissed. I am of opinion that the use of an oil or oily liquid in defendant's separation process in a quantity not "amounting to more than a fraction of one per cent. on the ore"* is within the express terms of claims 1, 2, 3 and 12 of plaintiff's patent and is an infringement of such patent. But I am of opinion that the use of oil or oily liquid in a quantity amounting to

**Judge Hunt here reiterates the view expressed in the reversed opinion of his court in the Hyde case, that the Cattermole process produces a mineral-carrying froth, overlooking the clear statement in the decision of this Court reversing that decision, that the Cattermole process is a metal-sinking process—as it indubitably is. He also avoids characterizing the results of the invention as *new*, but merely says they were "remarkable and great," presumably from a financial standpoint.

*This is an accurate expression but not an exact quotation. The specification says, "if the proportion of oily substance be considerably reduced —say to a fraction of one per cent. on the ore," and claims 1, 2 and 3 say, "amounting to a fraction of one per cent. on the ore." This last expression is quoted in the opinion of this Court. Claim 12 says, "a fraction of one per cent. of oil on the ore."

more than a fraction of one per cent. on the ore is not within the terms of claims 1, 2, 3 and 12 and is therefore not an infringement upon plaintiff's process and that a decree should be entered accordingly.** The direction of the Supreme Court in Minerals Separation Ltd. vs. Hyde, 242 U. S., 261, is that:

> "The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as critical proportions amounting to a fraction of one per cent. on the ore."

The term critical proportions is not used in the claims of the patent but such proportions were described in the testimony in the Hyde case as the application of a small but exact quantity of oil to different ores and always within the range of treatment of "a fraction of one per cent. on the ore," never to the treatment of different ores within the range of "one-half of one per cent." except in the use of oleic acid and that upon certain ores such as Broken Hill ores. The application of the term "critical proportions" in the use of oil on ores generally within a range of "one-half of one per cent." was discovered by counsel for appellant in this case and so far as appears from the record was revealed to the public for the first time in this court.

The colloquy between Mr. Justice McReynolds and Mr. Kenyon, counsel for appellant, in the Supreme Court in

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**Judge Morrow, without giving his reasons therefor, here rejects the definite evidence and admissions by defendant which establish the fact beyond question that from the commencement of use of the process defendant successfully used much less than one per cent. of efficient or useful mineral-froth-forming oil, and has always continued so to use it; and that the effort to escape infringement consisted in adding, to a small fraction of one per cent. of this useful oil, a larger quantity of other oils which were not useful or mineral-froth-forming oils of the process, but which increased the total quantity of oil used so that it slightly exceeded one per cent., thereby impairing but not destroying the operation and results of the process in suit.

the Hyde case, referred to by Judge Ross in his opinion, related to the use of oleic acid on Broken Hill ores concerning which I do not understand that there is any controversy. I think the direction of the Supreme Court that

> "The patent must be confined to the results obtained by the use of oil within the proportions * * * amounting to a fraction of one per cent. on the ore"

means just what it says, and that within such proportions the process described in the patent is held by the Supreme Court to be a valid discovery protected by the Specifications and Claims numbered 1, 2, 3 and 12. The Supreme Court does not say that the patent must be confined to the oleic acid claims (claims 5, 6 and 7), nor does it say that the other claims of the patent must be confined to the use of oil in the fraction mentioned in those claims.* Had the Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one-half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in claims 5, 6 and 7. For what purpose does the court hold claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions "amounting to a fraction of one per cent. on the ore"; that is to say, upon ores generally.

The specifications mention the fact that the ores were not all alike and that different ores may require the use of different proportions of oily material in order to secure the desired separation of metalliferous matter from the gangue by the production of a froth. The Supreme Court commenting upon this variation in the requirements of the process said:

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*The upper limit stated in these oleic acid claims is one-half of one per cent. on (relative to) the ore.

> "Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject-matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows."

The use of oleic acid on Broken Hill ore was the oil and the ore of the discovery and the proportion of the oil used is described in claims 5, 6 and 7. But how about the use of other oils on other than Broken Hill ores? The proportions required for oleic acid on Broken Hill ores had been determined by actual tests but other oils and other ores had not been fully tested and the application of the process might require a different proportion of oily material upon a different class of ores. To meet such a contingency, claims 1, 2, 3 and 12 call for the use of an oil or oily liquid "amounting to the [a] fraction of one per cent. on the ore." Furthermore, in declaring claims 9, 10 and 11 invalid, the Supreme Court clearly did so because such claims were not confined to the use of oil "amounting to a fraction of one per cent. on the ore." The claim was for the use of "a small quantity of oil," which might be a quantity more than "a fraction of one per cent. on the ore."

The validity of the other claims in controversy having been sustained upon their limitation of the use of oil within the proportions "amounting to a fraction of one per cent. on the ore," it followed that claims 9, 10 and 11 were held invalid because they were not so confined,

and were therefore too broad. The disclaimer accordingly disclaims from claims 9, 10 and 11 of the patent "any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore." Such language was strictly in accordance with the decision of the Supreme Court and I think a sufficient rejection of the excess from the invention claimed, leaving the patent in the form limited by the opinion of the Supreme Court.

With respect to the objection that the disclaimer was not filed in time, the mandate of the Supreme Court became effective January 13, 1917, decreeing the patent to be invalid as to claims 9, 10 and 11, but valid as to the other claims in issue. On March 28, 1917, the plaintiffs filed their disclaimer, some time before the right to petition for a rehearing in the Supreme Court had expired. Considering the importance of the procedure to be followed, the residence of the patentees in another country and the consequent delay in communication, the date of filing was not unreasonably delayed.

At a stated Term, to-wit: the October Term A. D. 1917, of the United States Circuit Court of Appeals for the Ninth Circuit, held in the Court-Room thereof, in the City and County of San Francisco, in the State of California, on Monday the twentieth day of May, in the year of our Lord One Thousand Nine Hundred and Eighteen.

Present—Honorable WILLIAM B. GILBERT, Senior Circuit Judge, Presiding,
Honorable ERSKINE M. ROSS, Circuit Judge,
Honorable WILLIAM H. HUNT, Circuit Judge.

BUTTE AND SUPERIOR MINING COMPANY, Designated as BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, a Corporation,

Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation; MINERALS SEPARATION NORTH AMERICAN CORPORATION, a Corporation,

Appellees.

No. 3081.

ORDER MODIFYING DECREE.

ROSS, Circuit Judge, HUNT, Circuit Judge, concurring, MORROW, Circuit Judge, concurring in the reversal but dissenting from the modification of the decree herein directed and as to costs.

Understanding from the presentation of this case that the real and pivotal question for the decision of this Court was whether or not under the decision of the Supreme Court in the case of Minerals Separation, Ltd. vs. Hyde, 242 U. S., 261, the use of any oil by the appellant in quantity of one per cent. or less on the ore, constituted an infringement of the appellees' patent, and that the fact was undisputed that the appellant had not used as little as one-half of one per cent. of oil in its process, in reversing the judgment of the court below we directed that court to dismiss the bill at the complainant's cost.*

Inasmuch, however, as it appears and is admitted that prior to and including January 7, 1917, the appellant did use in its process oil in quantities of one-half of one per cent. and less, thereby in those instances infringing the patent of the appellees.

It is hereby ordered that the judgment of this Court herein rendered and entered May 13, 1918, be and hereby is corrected so as to read as follows:

The decree appealed from must be and is reversed and the case remanded with directions to the Court below to so modify its decree as to accord with the opinions of the majority of this Court, the appellant to recover its costs on this appeal.

Entered May 20, 1918.

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*This was the direction concluding the opinion of the Court, by Judge Ross, as originally filed (see footnote, *supra*, p. 32) and the decree so ordered as originally filed. The opinion and original decree were corrected, after filing, to their present form to accord with this order modifying decree. Thus a final decree dismissing the bill was corrected to a decree final as to all acts of defendant employing more than one-half of one per cent. of oil relative to the ore and finally adjudicating that the defendant infringed in all acts employing one-half of one per cent. or less of oil relative to ore, but interlocutory as to the latter acts in that an accounting was ordered.

NOTICE.

THOMAS F. SHERIDAN,
J. EDGAR BULL,
FREDERICK P. FISH,
J. BRUCE KREMER,
Counsel for Butte & Superior Mining Company.

Gentlemen:

Will you please take notice that on Monday the 7th day of October, 1918, at 12 o'clock noon, or as soon thereafter as counsel can be heard, the foregoing Petition and Appendix and the accompanying Brief and Appendix will be submitted to the Supreme Court of the United States at its usual place of holding its sessions in the Capitol at Washington, D. C., for its consideration and action, at which time and place you will please take such action in the premises as you may be advised.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Counsel for Petitioners.

ADMISSION OF SERVICE.

Service of a copy of the foregoing Petition and Appendix and accompanying Brief and Appendix is acknowledged this day of August, 1918.

AUG 8 1918
JAMES D. MAHER
CLERK

Supreme Court of the United States

OCTOBER TERM 1918.

No. 599

MINERALS SEPARATION, LIMITED, MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, and MINERALS SEPARATION NORTH AMERICAN CORPORATION,

Petitioners,

against

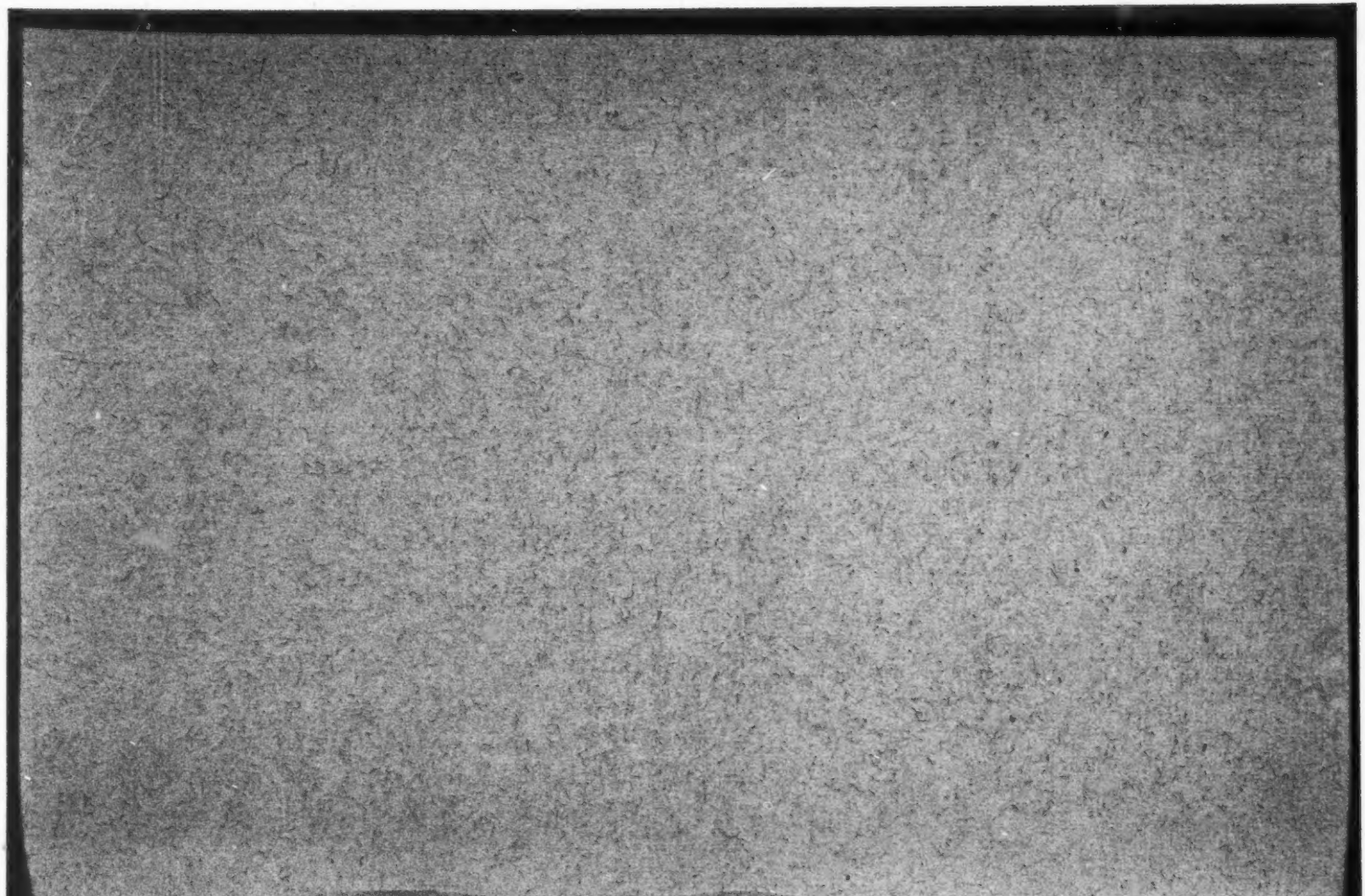
BUTTE & SUPERIOR MINING COMPANY,

Respondent.

On Petition for a Writ of Certiorari to be addressed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit.

PETITION FOR CERTIORARI AND APPENDED OPINIONS OF THE THREE JUDGES OF THE CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT WITH ANNOTATIONS COMPARING THE SAME WITH THE OPINION OF THIS COURT IN MINERALS SEPARATION, LIMITED, vs. HYDE, 242 U. S., 261.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
OWELL W. MCCONNELL,
Counsel for Petitioners.



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Supreme Court of the United States

MINERALS SEPARATION, LTD., MINERALS SEPARATION AMERICAN SYNDICATE, LTD., and MINERALS SEPARATION NORTH AMERICAN CORPORATION,
Petitioners,

against

BUTTE & SUPERIOR MINING COMPANY,
Respondent.

PETITION FOR WRIT OF CERTIORARI TO BE ADDRESSED TO THE JUDGES OF THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

To the Supreme Court of the United States.

Your petitioners Minerals Separation Ltd., Minerals Separation American Syndicate, Ltd., and Minerals Separation North American Corporation, respectfully show:

Your petitioners are the owners of the title to and of all rights to profits and damages for infringement of United States Letters Patent No. 835,120 to Sulman Picard and Ballot of November 6, 1906, for a process of Ore Concentration, and this suit is for an injunction and accounting for infringement of that patent.*

*The statement of proceedings preceding the opinion of the Circuit Court of Appeals for the Ninth Circuit outlines the proceedings in the instant case from the commencement of the suit on October 10, 1913, to the argument of the appeal, and is reprinted in the Appendix to this Petition (*infra* p. 21; also R., Vol. p.).

This suit involves the same patent as was passed upon by this Court in the case of Minerals Separation, Limited, and Minerals Separation American Syndicate, Ltd., vs. James M. Hyde, 242 U. S., 261, the defendant and respondent Hyde in that case having initiated for the Butte & Superior Mining Company, defendant and respondent here, the acts of infringement adjudicated in that case.

Butte & Superior Mining Company, respondent here, carried on in its mill by its employees with its own ore and for its own profit, the acts adjudicated by this Court in that suit to be an infringement, the defendant Hyde in that suit having merely initiated and for a time superintended those acts. The respondent here has continued the infringement initiated by Hyde.

In the Hyde suit in this Court the decree of the Circuit Court of Appeals for the Ninth Circuit declaring the patent invalid was reversed and the validity of the patent was affirmed (242 U. S., 261).

In reaching its conclusions in that case this Court found that the process of the patent in suit produced a result never obtained before, and that the advance on the prior art and the resulting froth concentrate obtained, so different from the product of other processes, made it a patentable discovery. This Court found novelty, principally, in the buoyancy of air bubbles (which formed a multitude of air cells) floating the metal particles—in the principle of action and the results obtained by the use of oil within the "critical proportions" set forth in the claims of the patent amounting to a fraction of one per cent. on (relative to the ore, and affirmed without limitation all of the claims wherein such results and proportions were prescribed.

In the instant case the Circuit Court of Appeals for the Ninth Circuit, interpreting and applying that decision on an issue of infringement, has, on the sole basis of their interpretation of that decision, reversed the holding of infringement made by the District Court.

The Circuit Court of Appeals in the decree as first entered by it in the instant case found against the plaintiff on all issues, reversed the decree of the Court below and ordered a dismissal of the bill. Subsequently and upon having its attention called to the fact that it had overlooked an admitted infringement of five and a half years, it entered an order modifying the decree (infra, p. 42), and altered its decree to sustain the bill to the extent of the admitted infringement, thereby in effect ordering an injunction and accounting in respect thereof. Thus a final decree was altered to an interlocutory decree without altering the opinions of the Court upon the disputed issues, and the decision is in fact a final decision upon all the disputed issues, and it denies injunction against the present infringement, and as to the accounting for the admitted infringement it leaves the matter in such condition as may well affect the whole theory and basis of that accounting.

We believe and respectfully submit that the Circuit Court of Appeals has wholly misunderstood and misinterpreted and misapplied the decision of this Court in the Hyde case.

The Circuit Court of Appeals for the Ninth Circuit in its decision in the Hyde case (214 Fed., 100) had held the patent wholly invalid on the finding that there was nothing novel in the process, either in ingredients, manipulation, operation or result, and that the only discovery made was that oil could be saved in an old process and that this was merely a matter of degree, the work of the engineer, and not patentable.

This Court in the Hyde case, as stated, reversed the Circuit Court of Appeals and held the patent valid as for a new process, reaching a result never obtained before, by a novel principle of operation, concluding that

> "this advance on the prior art and the resulting froth concentrate so different from the product of other pro-

> cesses make of it a patentable discovery as new and original as it has proved useful and economical" (242 U. S. 269).

This Court described and classified the processes of the prior art and described and contrasted the process of the patent in suit and defined the novelty of operation and the novelty of result, thereby establishing *criteria* by which to test the presence or absence of the invention.

In the instant case the District Court has applied these criteria in finding infringement.

But the Circuit Court of Appeals for the Ninth Circuit has not.

On the contrary it refers to its own previous opinion with respect of the prior state of the art and the relation of the process in suit thereto and assumes that the conclusions it there expressed, to wit, that all froths are of an essentially like character and that the achievement was merely a saving in oil, still hold good.

The Circuit Court of Appeals overlooks the fact that its conclusions in that regard were reversed by this Court in the Hyde case. It has determined the question of infringement in disregard of and contrary to the *criteria of invention* postulated by this Court. The scope and reasoning of its opinions and the effect of its decision are such as to nullify the decision of this Court in the Hyde case as to the character and value of the invention of the patent in suit, and are in conflict with the findings of fact that were made by this Court in that case and with the reasoning upon which those findings were based.

Because of this fundamental conflict with, and divergence from, the decision of this Court in the Hyde case, the Circuit Court of Appeals in the instant case has erroneously imputed to this Court a decision that the invention and the patent are limited to the use of *one-half of one per cent.* or less of *any* oil or oily substance that

has a preferential affinity for metalliferous matter over gangue.

Two errors of interpretation are here involved, namely:

First, the imputed limitation of the patent to the use of *one-half of one per cent.* of oil or oily substance, and

Second, the imputed extension of the patent to *any* oil or oily substance having a preferential affinity for metalliferous matter over gangue, *whether capable of effectuating the process or not.*

The first error renders the decision of this Court in the Hyde case nugatory as to a substantial portion of the field clearly intended to be covered thereby, because claims 1, 2, 3 and 12, which as to oil proportions specify "a fraction of one per cent." on the ore, were sustained by this Court as valid without limitation and so as to include every fraction of one per cent. which would effectuate the process.

The second error renders the decision of this Court in effect wholly nugatory, because it would permit an unauthorized user of the process to escape the charge of infringement by using the process in every detail (including the small quantity of suitable oil determined as prescribed in the patent and added in the critical proportions required) and simply adding a further quantity of another oil or oily substance which, although incapable of effectuating the process when used alone, would yet not destroy the action of the suitable oil of the process. This is what respondent has done.

The fact that such alien or non-functioning oils could be so used was not proved or known in the Hyde case. It appears in the instant case, however (R., Vol. , p.

, Q.) that after the testimony in the Hyde case was closed, one of the respondent's employes, experimenting in the laboratory with thousands of different oils, discovered that with respondent's ore certain petroleum oils (although incapable alone of effectuating the process) could be used in admixture with oils and oily substances capable of effectuating the process, without defeating the process, even in such amounts as to make the total mixture of effectual and ineffectual oils one per cent. or slightly more.

Immediately after the decision of this Court in the Hyde case, the respondent, after certain experiments in the mill, added to the critical proportions (one-tenth to two-tenths of one per cent. on the ore) of pine oil, a highly effectual oil of the process and which it had been using in those critical proportions for several years in admitted infringement of the patent in suit, a mixture of fuel oil and kerosene oil, which separately or together were ineffectual to achieve the process, and which were confessedly added for the mere purpose of avoiding the patent in suit. This fuel oil and kerosene oil were added in the treatment of a considerable tonnage of ore, extending over a period of about two months, in such amount as to bring the total oil mixture used to more than one-half of one per cent., and later on to slightly above one per cent. on the ore. The operations constitute the acts of infringement in controversy.

After this addition of fuel oil and kerosene, the process remained identically the same in character, in mode of operation, in the factors that did the work, in the principles of action involved, and in the results obtained. Respondent did not alter the process, but merely impaired it, by the addition of the ineffective weight-making diluent oils, as was proved in evidence and found by the trial Judge and not questioned by the Circuit Court of Appeals.

Nevertheless, wholly upon the basis of the decision imputed to this Court in the Hyde case by the Circuit Court of Appeals, the full Court reversed the District Court, holding non-infringement during the period when one per cent. or more of oil mixture was used and the majority of the Court, going still further, held non-infringement during the period when any amount over one-half of one per cent. of oil mixture was used.

If the principles and matters decided by this Court in the Hyde case are to be maintained, it is necessary that the decision of the Circuit Court of Appeals for the Ninth Circuit in the instant case should be brought here for review since the latter decision not only opposes but nullifies the former in respect thereof.

Because of the persistence of the Circuit Court of Appeals for the Ninth Circuit in the instant case in the errors and mistakes of its own opinion in the Hyde case as to the character of the invention in suit and its relation to the prior art, there is the same variance between the foundations of its decision in the instant case and the decision of the House of Lords (referred to by this Court in its opinion in the Hyde case) that existed between its decision in the Hyde case and that decision in the House of Lords, and the reasons that existed for granting the Petition for Writ of Certiorari in the Hyde case are again present.

And in addition there is the further variance created by the decision of the Circuit Court of Appeals for the Third Circuit in the Miami case (244 Fed., 752), hereinafter referred to, where the broad view of the invention set forth by this Court and by the House of Lords is set forth at large and emphatically.

To state the facts somewhat more in detail the Circuit Court of Appeals for the Ninth Circuit, in its decision in the Hyde case, reviewed the prior art processes and stated its conclusion as to those processes and that of the patent in suit "that the froth in all these processes is the same with the exception that there is less oil • • • in the appellee's froth than in the others" (214 Fed., 106, 107). It held that "the fact that the appellees use a smaller quantity of oil than was used in the prior art is not of itself, and is not claimed by them to be, sufficient to distinguish their process so as to render it patentable. To discover that the desired result may be accomplished with the use of a fraction of one per cent. of oil when formerly a much larger quantity of oil had been used and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. It is a difference of degree and not of kind" (214 Fed., 105).

In reversing that decision this Court held in respect of the process of the patent in suit that "it differs so essentially from all prior processes in its character, in its simplicity of operation, and in the resulting concentrate that we are persuaded that it constitutes a new and patentable discovery" (242 U. S., 266). This Court further adopted the statement that the process of the patent in suit "produces a result never obtained before" (idem, p. 268) and concludes, as above quoted, "that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical" (*idem*, p. 269).

In the instant case Judge Bourquin, District Judge of Montana, after a trial in open court lasting five weeks, applying the criteria of invention postulated by this Court in the Hyde case, found the defendant guilty of infringement in every instance wherein it had beneficially used

any fraction of one per cent. of oil to produce the mineral froth. This included all operations charged by your petitioners to be infringements.

Judge Bourquin's opinion in the instant case recites the important facts as to the infringing acts of the defendant. It says that defendant, after years of successful operation using at first 5.58 lbs. of oil to the ton of ore (0.28%) and finally 1.43 lbs. (0.07%) in the treatment of about 1,600,000 tons of ore, changed these operations in no other substantial respect than that it added other and ineffective oils so that the aggregate amount of the oil mixture was one per cent. or slightly more.

Judge Bourquin says:

> "Before January 7th, 1917, defendant used only pine oil and about 1.43 lbs. per ton of ore, with excellent results. Since said date it uses a mixture of 20 to 24 pounds of oil per ton of ore [1% to 1.2% on the ore], made up of 18% of pine oil [0.18% to 0.22% on the ore], 12% of kerosene oil and 70% of fuel oil [an aggregate of from 0.82% to 0.98% on the ore of petroleums], with poorer results. * * * As before stated, many oils are ineffective to operate the process, and that is because they have not the quality that contributes to bubble making. What this quality consists of, wherein it lies, does not appear. With these ineffective oils, agitation will not produce froth and so there is no flotation of the metallic particles. * * * Petroleums seem generally ineffective by the evidence of both parties, though some of defendant's witnesses testify to sometime successful experiments with them. Incidentally, there is suspicion that with experiments, as with figures, can be done anything for or against, without impropriety in the operator. Some petroleums are used in limited quantities, but always in combination with a recognized bubble making oil, and only, it is said, for a somewhat bubble stabilizing effect. Defendant's present mixture of oil contains more pine oil on the ore [a maxi-

mum of 0.22% as contrasted with a minimum of 0.07%] than it used alone before January 7th, 1917. The other factors the same, it is obvious the excess petroleums in the mixture are responsible for the poorer results.

"Defendant uses the patent process, uses plaintiffs' invention of ore concentration by air bubble flotation, uses the same elements in the same combination in the same way with the same function to the same but poorer results; and exceeding the patent claims in reference to one ingredient (oil) uselessly, wastefully and injuriously and merely with intent to avoid the letter of the patent, does not avoid infringement. The addition of the excess oil no more adds to or changes the process, no more avoids infringement, than would the addition of milk or other useless substance not a part of the process. The excess oil exercises either no function or less efficiently exercises the same function in the same way as the limited oil, and to the same but poorer results. To secure to patentees their invention, the law looks quite through mere devices and forms, to the substance of things. And if in substance the invention is taken, if the thing that does the work is taken, all devices to evade the letter of the patent avail nothing to escape the consequences of infringement" (R., Vol. 1, pp. 101, 102; bracketted insertions ours).

Judge Bourquin also said:

"Patent law is not concerned with the useless, and a valuable result sought is not 'obtained' by but *despite* the use of an excess of an essential ingredient, which excess renders no or ill service. From the evidence it appears the larger part of the oil used by defendant and all in excess of a fraction of 1% on the ore, if not inert, is ineffective, wasted and injurious to the process and results" (R., Vol. 1, p 101, italics Judge Bourquin's).

Additionally it may be noted that the change in defendant's procedure after January 7, 1917, involved first

and for a period of about two months, the addition to the useful mineral-froth-forming oil (pine oil) of such an amount of the ineffective oils (petroleums) as to make the total oil proportion greater than one-half of one per cent. and less than one per cent., and this in the treatment of about 77,000 tons of ore (R., Vol. p.). Thereafter the total oil proportion was in like manner increased to one per cent. or slightly more.

An appeal was taken by the defendant to the Circuit Court of Appeals for the Ninth Circuit and was heard there by Judges Ross, Morrow and Hunt. A majority of the Court, Judges Ross and Hunt (Judge Morrow dissenting) interpreted the opinion of this Court in the Hyde case as confining the patent to the use of one-half of one per cent. or less of oil or oily substance on the ore, and the full court agreed in interpreting the opinion of this Court as expanding the patent to cover the use of any and every oil and oily substance having a preferential affinity for metalliferous matter over gangue, whether the oil or oily substance thus used was useful or useless, beneficial or harmful (Opinion by Judge Ross, *infra*, p. 23, with annotations; also R., Vol. p. ; concurring opinion by Judge Hunt, *infra*, p. 32, with annotations; also R., Vol. p. ; opinion in part dissenting, by Judge Morrow, *infra*, p. 37 with annotations; also R., Vol. , p.).

These opinions were not based upon the independent judgment of these judges as to the question of infringement presented but upon their opinion as to the limitations imposed upon the patent by the decision of this Court in the Hyde case.

Thus the opinion of the Court, by Judge Ross, says:

> "Nothing, it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court than that it did not intend to extend the monop-

> oly of the patent in suit to the use of one per cent. of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellee's 'experimenters' only rose to the dignity of *invention* when they ascertained that the desired results could be and were obtained by the use of five-tenths (½) of one per cent. of oil on the ore, with still better results as the quantity was reduced, to the vanishing point at less than one-tenth of one per cent. The quantity of oil that gave birth to the invention—five-tenths (½) of one per cent. on the ore (at which point no more granulation exists)—to the lesser and extreme limit of the minute quantity (less than one-tenth of one per cent.)—at which the desired result ceases, are the 'critical proportions,' 'amounting to *a* (italics ours) fraction of one per cent. on the ore,' to which the appellees' patent is 'confined' by the Supreme Court as we understand its opinion" (*infra* p. 29; R., Vol. 1, p.).

In reaching its conclusion in the instant case as to the imputed limitation of the patent to one-half of one per cent. of oil the majority of the Circuit Court of Appeals for the Ninth Circuit refer to its own previous opinion in respect of the prior state of the art as establishing that the results of the prior art processes and of the process of the patent in suit were identical, except for a difference of degree, and construe the opinion of this Court in the Hyde case as affirming the patentability of the discovery in respect only of a particular degree of saving in oil. They quote this Court's reference to the evidence in the Hyde suit of the birth of the invention, that is, of the incidents at the time of the discovery, when a specific oily liquid (oleic acid) was used with a specific ore (Broken Hill ore) under specific conditions of heat, acidity and agitation, and from it they impute to this Court the implication that, since the phenomena only began to appear at one-half of one per cent. *under the conditions*

then existing, those are the limits of patentability under *all conditions,* and therefore the claims (despite the evident meaning and legal effect of their language) do not protect the patentees excepting within those limits as to *all ores* and *all oils* and *all conditions.* They select from the opinion of this Court in the Hyde case certain phrases in respect of proportions of oil, etc., from which they deduce the conclusion that in holding valid the claims of the patent prescribing the use of oil amounting to a fraction of one per cent. on the ore this Court intended to limit such fraction to one-half of one per cent. or less, and they find confirmation of this understanding of the opinion of this Court by adverting to a colloquy occurring during the argument of the Hyde case between certain members of the Court and counsel for the plaintiff (which related to oleic acid and Broken Hill ore and did not relate to the scope of the claims or to the boundaries of the invention in general), and Judge Hunt finds confirmation also in the details of the particular example described in the patent specification.

Judge Morrow dissented from the view that this Court intended in any way to restrict the claims prescribing "a fraction of one per cent." of oil relative to ore to any particular fraction, and expressed the opinion that on the contrary this Court intended them to be read in their natural meaning as they appear, and intended that the patent should cover the use of oil in any and every fraction of one per cent., so long as the novel results were obtained (*infra,* p. 37; R., Vol. , p.). We quote from his opinion as follows:

> "I think the direction of the Supreme Court that 'the patent must be confined to the results obtained by the use of oil within the proportions * * * amounting to a fraction of one per cent. on the ore' means just what it says, and that within such proportions the process described in the patent is held by the

> Supreme Court to be a valid discovery protected by the Specification and Claims numbered 1, 2, 3 and 12. The Supreme Court does not say that the patent must be confined to the oleic acid claims (claims 5, 6 and 7), nor does it say that the other claims of the patent must be confined to the use of oil in the fraction mentioned in those claims. Had the Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one-half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in claims 5, 6 and 7. For what purpose does the Court hold claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions 'amounting to a fraction of one per cent. on the ore'; that is to say upon ores generally" (*infra*, p. 39; Vol. , p.).

There is nothing in the opinion of this Court in the Hyde case which in any way restricts the natural meaning of the language employed in the claims which it held valid. On the contrary it distinctly says that the patent reaches out to "the terms of the claims" (242 U. S., 271). It did confine the whole patent to what it found were the novel results of the process by holding invalid certain other claims that were not confined to those results, but it said that "variation of treatment must be within the scope of the claims" (*idem*, 270) and that "range of treatment within the terms of the claims" (*idem*. 271) would be within the scope of the patent.

The opinion of this Court in the Hyde case found that the discovery was of a new process obtaining results that had never been obtained before and that it was patentable. The disagreement with the decision of the Circuit Court of Appeals for the Ninth Circuit then under review was not, of course, as to the principle of law that

a mere difference of degree is not patentable, for that principle is well settled. The fundamental difference and disagreement was in respect of the prior state of the art and the character of the invention of the process in suit. The novelty of the operation and of the results was pointed out both by contrast and by definition. The fact that "the composition of ores varies infinitely" was pointed out. The fact that "when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary to obtain the best results" (242 U. S., 271), was stated. So far from limiting the natural meaning of the language of those claims which specified "a fraction of one per cent.," this Court quoted that language from the claims and adjudged the validity of all claims which employed that language. It also adjudged the validity of the narrower claims, limited to oleic acid, wherein the upper limit specified of oleic acid was one-half of one per cent. on the ore. In adjudging the validity of claims 1, 2, 3 and 12, which specified "a fraction of one per cent." of oil, it made no statement whatsoever limiting or narrowing their scope as to oil quantity to the scope of claims 5, 6 and 7, which specified an upper limit of one-half of one per cent. of oleic acid. It said that "variation of treatment must be within the scope of the claims" (242 U. S., 270), but it did not limit the scope of the claims which it adjudged to be valid to anything less than the natural meaning of the words of these claims themselves.

Moreover there is nothing in the opinion of this Court in the Hyde case which expands the patent and its claims to cover the use of any and every oil or oily substance having a preferential affinity for metalliferous matter over gangue, whether capable of effectuating the process or not. On the contrary this Court distinctly says that the patent must be confined to such processes as obtain the results it

specifies—an exclusion that applies as much to an oil that because of its quality cannot obtain those results as to an oil that because of its excessive quantity cannot obtain those results.

These misinterpretations and misapplications in the instant case of the opinion of this Court in the Hyde case result in nullifying the value of a patent adjudged to be valid by this Court, by opening the door to infringers who merely disguise their operations by adding a useless diluent to the critical proportions of oil effectuating the process. They disturb settled principles of law and confuse the state of the law, not only in the widespread litigation under the patent here in suit, and in the relations to it of a great and important industry, but also in respect of other litigations wherein similar principles of law are applicable.

The circumstances of this suit make it closely analogous to those cases in which a court of subordinate jurisdiction has not properly carried out the mandate of a superior Court in the same case. While the defendant in the present case may not technically be in privity with the defendant in the Hyde case, the patent is the same, the process is the same, the defendant here employed the defendant there and participated in the act of infringement there and is sued here for that participation as well as for its continuance of the infringment; and we respectfully submit that the Circuit Court of Appeals of the Ninth Circuit has not in fact carried out the decision of this Court in the Hyde case, but has, on the contrary, perverted its meaning and nullified its effect by limiting all the claims of the patent to the use of one-half of one per cent. of oil on the ore, and by not limiting them to oil or oily substances that will do the work of the process in the way described in the specification and recited in the claims and set out in the opinion of this Court.

The numerous decisions wherein the process here in suit has been considered may be tabulated as follows:

British Ore Concentration Syndicate, Ltd., vs. Minerals Separation, Ltd., 25 R. P. C., 741, High Court of Justice, Chancery Division; affirmed after intermediate reversal in the Court of Appeals by the House of Lords in

Minerals Separation, Ltd., vs. British Ore Concentration Syndicate, Ltd., 27 R. P. C., 33.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, Ltd., Supreme Court New South Wales, 31 R. P. C., 216, 217.

Ore Concentration Company, Ltd., vs. Sulphide Corporation, 31 R. P. C., 206, Privy Council British Empire.

Minerals Separation, Ltd., vs. Hyde, 207 Fed., 956 (D. C. Montana).

Hyde vs. Minerals Separation, Ltd., 214 Fed., 100 (C. C. A., 9th Circuit).

Minerals Separation, Ltd., vs. Hyde, 242 U. S., 261.

Minerals Separation, Ltd., vs. Miami Copper Co., 237 Fed., 609 (D. C. Delaware).

Minerals Separation, Ltd., vs. Miami Copper Co., 244 Fed., 752 (C. C. A., 3rd Circ., including dissenting opinion by Judge Buffington, p. 775).

Minerals Separation, Ltd., et al., vs. Butte & Superior Mining Co., 245 Fed., 577 (the present case, D. C. Montana).

Butte & Superior Mining Co. vs. Mineral Separation, Ltd., et al., not yet reported (the present case, C. C. A., 9th Circuit; *infra*, p. 21; R., Vol. , p.), on which were entered the decree of May 13, 1918 (R., Vol. , p.), and the order modifying decree of May 20, 1918 *infra*, p. 42; R., Vol. , p.).

Of the above judicial judgments and opinions, all of the British cases above cited are in entire harmony with the

opinion of this Court. Additionally the opinions of all the trial judges in this country are in harmony with the opinion of this Court—Judge Bradford's opinion in the Miami case, following a nine weeks' trial in open court and rendered just prior to the argument of the Hyde case in this Court, and Judge Bourquin's opinion in the instant case, following a five weeks trial in open court.

Two Circuit Courts of Appeal, those of the Third and Ninth Circuits, have applied the decision of this Court in the Hyde case. The decision of the Ninth Circuit is the one that we seek to bring here for review and has heretofore been dealt with, the judges disagreeing two to one on the matter of limitation to one-half of one per cent. of oil. In the Third Circuit (Minerals Separation, Ltd., vs. Miami Copper Company, 244 Fed., 752), all of the judges expressed the broad view of the novelty and character of the process that this Court expressed and unquestioningly assumed that the claims of the patent protect the patentees in respect of the use of oil in any and every fraction of one per cent. of oil on the ore where the novel result is obtained. This point was not directly involved in the suit, but the assumption, as above stated, appears in the two opinions filed. That Court disagreed two to one upon another matter involved in the decision of this Court in respect to this patent, which need not at this time be considered.

A great, important and widespread industry, that of mining and producing zinc, copper, lead, silver, gold and other metals, is now in uncertainty by reason of the misinterpretation and misapplication in the instant case of the decision of this Court in the Hyde case, as to the true meaning of that decision as applicable to its daily operations. So also the varying interpretations of this decision in the Third Circuit have introduced a further element of uncertainty in the mining community which could be clarified by a review of the instant case.

Your petitioners are advised and believe and therefore assert that the decree of the Circuit Court of Appeals for the Ninth Circuit herein is erroneous, and that the matters and questions involved in said decision, being but variations of the same matters and questions involved in the Hyde case, are of such grave and general importance that this Honorable Court should require the said cause to be certified to it for its review and determination, in conformity with the provisions of the Act of Congress in such cases made and provided, particularly as the said decision of the Circuit Court of Appeals for the Ninth Circuit is expressly based upon an erroneous interpretation of the decision of this Court in the Hyde case which renders that decision nugatory.

WHEREFORE because of the gravity and importance of the questions involved and in the interest of uniformity of decision, and to make practically effective the decision of this Court in the Hyde case, your petitioners respectfully pray that a writ of certiorari may be issued out of and under the seal of this Court, directed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit, commanding them and each of them to certify and send to this Court on a day certain to be therein designated, a full and complete transcript of the record and of the proceedings of the said Circuit Court of Appeals in the case lately depending therein entitled "Butte & Superior Mining Company, Appellant, *versus* Minerals Separation, Limited, Minerals Separation American Syndicate, Limited, and Minerals Separation North American Corporation, Appellees, No. 3081" to the end that the decree of said Circuit Court of Appeals in said case may be reviewed as provided in Section 6 of the Act of Congress entitled "An Act to establish Circuit Courts of Appeals and to define and regulate in certain cases the jurisdiction of the Courts of the United States, and for

other purposes," approved March 3, 1891, and may be reversed by this Honorable Court to the extent that it reverses or modifies the decree of the District Court, and that your petitioners may have such other and further relief or remedy in the premises as to this Court may seem appropriate and in conformity with the said Act.

And your petitioners will ever pray.

MINERALS SEPARATION, LIMITED,
By JOHN BALLOT,
Chairman and Director.

MINERALS SEPARATION
AMERICAN SYNDICATE, LIMITED,
By JOHN BALLOT,
Chairman and Director.

MINERALS SEPARATION
NORTH AMERICAN CORPORATION,
By JOHN BALLOT,
President.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. MCKENNEY,
GARRET W. MCENERNEY,
ODELL W. MCCONNELL,
Counsel for Petitioners.

Appendix.

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,

FOR THE NINTH CIRCUIT.

BUTTE & SUPERIOR MINING COMPANY, Appellant, vs. MINERALS SEPARATION LTD., et. al., Appellees.	No. 3081.

OPINIONS.

This is an appeal from the decree of the United States District Court for the District of Montana, sustaining Letters Patent No. 835,120, issued to Sulman, Picard and Ballot on November 6, 1906, for a process of ore concentration, and adjudging the appellant herein to have infringed the same.

The appellees, two British corporations and one domestic corporation, are the legal owners of the title to the patent in suit, and of the rights to profits and damages for infringement thereof. The appellant is a domestic corporation, doing business at Butte, Montana, where the acts of infringement complained of were committed.

The suit was commenced on October 10, 1913, and a preliminary injunction sought. At the hearing on the motion for a preliminary injunction the pleadings and proceedings in the suit of Minerals Separation, Limited, et al., vs. James M. Hyde, in the United States District Court for the District of Montana, were offered and received in evidence, and are a part of the record herein.

That suit was upon the same patent and the issues were substantially the same as in the present case.

The answer of the defendant set up the defense of anticipation, and denied infringement. While the cause was at issue, but before trial on the merits, the Supreme Court of the United States rendered its decision in the Hyde case (242 U. S. 261), holding Claims 1, 2, 3, 5, 6, 7, and 12 of the patent to be valid, and Claims 9, 10, and 11 to be invalid.

The plaintiffs filed a supplemental and amended bill on May 1, 1917, during the trial of the case on the merits, pleading a disclaimer filed by them on March 28, 1917, and charging continued infringement of Claims 9, 10, and 11 of the patent, as limited by said disclaimer, and of the remaining claims.

To the plaintiffs' supplemental and amended bill of complaint defendant filed its answer on May 4, 1917, denying infringement and the validity of the patent by reason of lack of novelty and invention; alleged, further, that the patent had become wholly void and invalid by reason of the unreasonable neglect and delay of the plaintiffs to file a proper or any disclaimer in writing to Claims 9, 10, and 11, held to be invalid by the Supreme Court in the Hyde case; alleged, also, an estoppel against the claim of infringement by the use by the defendant of an amount of oil exceeding five-tenths of one per cent. on the weight of the ore, basing this defense upon a statement made by one of plaintiffs' counsel in the Supreme Court of the United States in the Hyde case, that the invention described in the patent was not reached or practiced until the amount of oil fell to or below five-tenths of one per cent. on the weight of ore treated by the process.

Upon the issues thus presented voluminous testimony was taken upon all the questions involved, which, as stated, were substantially the issues in the Hyde case,

restated and reconsidered by the lower court in the present case.

The court thereupon entered a decree in favor of the plaintiffs, in accordance with the conclusions of the opinion, holding that the plaintiffs were the owners of the patent in suit; that the processes employed by the defendant both before and after the filing of the bill of complaint, to and including January 7, 1917, embodied the invention of the patent and infringed Claims 1, 2, 3, 5, 6, 7, and 12 thereof, and Claims 9, 10, and 11, as limited by said disclaimer; and that the processes employed by the defendant from the 7th day of January, 1917, down to and through the time of the trial, embodied the invention of the patent and infringed Claims 1, 2, 3, and 12 thereof, and Claims 9, 10, and 11, as limited by the said disclaimer. The decree granted a permanent injunction against the further use of such process by defendant, and directed that an accounting be had for the assessment of damages accruing from such use. From that decree the defendant has appealed to this court.

Before—Ross, Morrow and Hunt, Circuit Judges.

ROSS, Circuit Judge: Notwithstanding the strenuous contentions on both sides of this litigation, the very elaborate preparations, and able arguments of many distinguished counsel, we can but regard the case as a very plain one.

To start with, the law is too well established to require discussion or the citation of authorities, that the patentees' rights under a patent are governed and limited by its valid claims—its specifications being referred to

only as illustrative of the true meaning of the claims. It is equally well settled law that the mere result of an invention is not patentable; nor is froth, or scum, or pine oil, or any other kind of oil, or oleic acid, patentable as such.

In their specifications the patentees of the patent in suit declare that their invention

> "relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like, from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue";

but of the claims of their patent adjudged by the court below to have been infringed by the appellant, not one specifies any particular kind of oil,* although the fifth and sixth specify as one of their constituents

> "a small proportion of oleic acid [which is an acid existing in most fats in combination with Glycoral], amounting to 0.2-0.5 per cent. on the ore,"

and we do not understand it to be contended that the appellant uses any oleic acid in its process.**

*While it is true that no claim (except the oleic acid claims 5, 6 and 7) specifies any particular oil or oily liquid by name, the claims very particularly specify the oil or oily liquid by function. Judge Ross curiously overlooks the fact that each and every claim (as well as the specification) in one form of words or another (claims 9, 10 and 11 by disclaimer) specifies that "the oil-coated mineral matter forms into a froth." This requires an oil that will obtain this result—that is, a mineral-froth-forming oil. If it will not do that, it is not the oil of the patent—at least not for that ore and for those conditions.

**This is true only of the latter part of the period of infringement. The defendant carried on in its mill by its employees with its ore and for its profit the act of infringement adjudicated by this Court in the Hyde suit wherein oleic acid was used as the oily liquid within the proportions specified in the most closely limited claims. These claims 5, 6 and 7, were adjudicated by this Court to be infringed by this act. All of these claims specify oleic acid as the oily liquid within the proportions quoted by Judge Ross, one-fiftieth of one per cent. to one-half of one per cent., inclusive, on (relative to) the ore. The defendant at bar continued to use

It is not denied that at the time of the invention in question the affinity of oil for the metalliferous portion of powdered ore, when mixed with water, was well known, as well as the further fact that the agitation of such a mixture with, as well as without, the addition of acid, would carry the metalliferous portions to the surface of the mixture and the gangue to the bottom; certainly those facts could not be successfully denied in view of the numerous references to the prior state of the art made in the opinion of this Court when this patent was last under consideration here and when the whole patent was by this Court held void as lacking invention (214 Fed., 100).*

That judgment was, it is true, reversed by the Supreme Court (242 U. S., 261). In doing so, however, the Supreme Court held invalid claims 9, 10 and 11 of the patent, each of which claims was for "a small quantity of oil."

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oleic acid as the only oily liquid of the process from August, 1911, until about June, 1913 (R., Vol. , p.), and then used a mixture of oleic acid and pine oil from June 13, 1913, until about December, 1914 (R., Vol. , p.).

Oleic acid, although not chemically an oil, but a fatty acid, has all the physical characteristics of an oil. It is in fact an oily liquid having a preferential affinity for metalliferous matter over gangue, and is an equivalent of an oil, as was adjudicated by this Court in the Hyde case in finding that claim 12, which simply says "oil," was infringed, as well as claims 1, 2 and 3, which specify "an oily liquid having a preferential affinity for metalliferous matter," and claims 5, 6 and 7, which specify oleic acid.

*This Court, in reversing the Ninth Circuit Court of Appeals in the Hyde case, destroyed that opinion as authority on the disclosures of the prior art. This Court said that the prior art disclosed processes in all of which *oil*, when impregnated or loaded with metal particles, was separated from the gangue, either by its buoyancy floating them to the surface or by its adhesiveness forming them into granules which sank. This Court said in substance that the process in suit differed from these prior disclosures in that it chiefly utilized the buoyancy of air, and "differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate, that we are persuaded it constitutes a new and patentable discovery." The Ninth Circuit Court of Appeals, in the opinion in the Hyde case referred to by Judge Ross as authority, said that all of these processes, those floating by oil and those sinking by oil, were substantially the same in kind as the process in suit, depending upon air flotation, with the single exception of the Elmore oil-buoyancy process. This Court said the process in suit was new in kind. The Ninth Circuit Court of Appeals said in its former decision that it was new only in degree, and persists in that view in the instant case notwithstanding reversal of that finding by this Court.

So that it is plain the appellees are not entitled to be protected in the use of "a small quantity of oil" of any kind, which, as is obvious, is a wholly indefinite quantity.

In holding claims Nos. 1, 2, 3, 5, 6, 7 and 12 of the patent valid to the extent that it did, the Supreme Court, after pointing out in its opinion that there were many investigators at work in the field to which the process in suit related when the patentees came into it, and that it was while engaged in study of prior kindred processes that their discovery was made, said:

> "While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (the former patents having used so much oil as to make its cost prohibitive—our observation; the barbed wire patent, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

Amounting to *a* fraction of one per cent. on the ore is very far from saying amounting to *every* fraction of one per cent. on the ore; *a* fraction is one thing, *every* fraction is a very different thing. It is obvious, we think, that if the Supreme Court had meant to extend the scope of claims 1, 2, 3, 5, 6, 7 and 12 of the patent to *one per cent.* of oil on the ore, as is here contended by the appellees,* it would not have said anything about any *fraction* of one per cent.—certainly there would have been no necessity for

*Appellees' (plaintiffs') contention was and is that when this Court quoted the words "amounting to a fraction of one per cent. on the ore" from claims 1, 2 and 3, and adjudged the validity of these claims and of claim 12 using similar language, it affirmatively held that these claims were valid to the full extent of their terms, and as to oil quantity covered every fraction of one per cent. of useful oil which would perform the new functions and produce the new results characterizing the invention.

doing so, and certainly the use of such specific language as it employed without a purpose cannot be justly imputed to that great tribunal.

That the "critical proportions" "amounting to a fraction of one per cent. on the ore," so protected by the Supreme Court in its decision does not include *every* fraction of one per cent. on the ore is, we think, very clearly shown by the same opinion where, after describing the prior state of the art, the Court said:

> "Into this field of investigation at this stage of its development came the patentees of the patent in suit. They were experienced metallurgists of London, of inventive genius and with financial resources, and they entered upon an investigation of the processes of oil concentration of ores which was continued through several years, and consisted of a very extended series of experiments in which the quantities of oil, of water and of acid used and the extent and character of the agitation of the mass under treatment resorted to, were varied to an almost unparalleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effect on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole 'Metal Sinking Process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore.' It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid

was used. This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface. The extent of the agitation of the mass had been increased as the experiments proceeded until the 'series of Gabbett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,100 revolutions per minute.'

"A careful consideration of the record in this case convinces us that the facts with respect to the process of the patent in suit are not overstated by the plaintiffs' witness, Adolf Liebmann, an expert of learning and experience, when he says in substance:

> 'The present invention differs essentially from all previous results. It is true that oil is one of the substances used, but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained before. The minerals are obtained in a froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals embedded in such manner that they form a complete surface all over the bubbles. A remarkable fact with regard to this froth is that, although the very slight and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for twenty-four hours without any change having taken place. The simplicity of the operation, as compared with the prior at-

tempts, is startling. All that has to be done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from two and one-half to ten minutes and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore.'

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical."

Nothing it seems to us, can be clearer from the foregoing quotations from the opinion of the Supreme Court, than that it did not intend to extend the monopoly of the patent in suit to the use of one per cent. of oil on the ore; for it, in effect, thereby distinctly declares and adjudges that the discovery of the appellee's "experimenters" only rose to the dignity of *invention* when they ascertained that the desired results* could be and were obtained by

*Here persists the erroneous idea of the Circuit Court of Appeals of the Ninth Circuit in the Hyde case that the "desired results" were old and well known and had often been obtained before, with the erroneous corollaries that this (the Supreme) Court had, in the Hyde case, merely decided that the ascertainment by Sulman, Picard and Ballot that these old and "desired results" could be obtained by a smaller quantity of oil than ever before, constituted patentable invention, and that this ascertainment of "the smallest quantity of oil that would produce the desired result" (Hyde vs. Minerals Separation, 214 Fed., 109), "rose to the dignity of invention" when the oil quantities fell to one-half of one per cent. on the ore.

the use of five-tenths (½) of one per cent. of oil on the ore, with still better results as the quantity was reduced to the vanishing point at less than one-tenth of one per cent. The quantity of oil that gave birth to the invention —five-tenths (½) of one per cent. on the ore (at which point no more granulation exists)— to the lesser and extreme limit of the minute quantity (less than one-tenth of one per cent.)—at which the desired result ceases, are the "critical proportions," "amounting to *a* (italics ours) fraction of one per cent. on the ore," to which the appellees' patent is "confined" by the Supreme Court as we understand its opinion.*

And that is just what appears from the present record was the contention of the present appellees before the Supreme Court on the argument of their appeal from the judgment of this Court holding that there was *no invention* in what they did. For it is undisputed that on the argument of that appeal this colloquy occurred between two of the justices and two of the attorneys for the then appellants and the present appellees:

> "Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.
>
> "Mr. Kenyon: At about one-half of one per cent. of oil.
>
> "Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

*The birth of the invention, as described by this Court, occurred while testing oleic acid with Broken Hill ore. With that oily liquid and that ore and under the other conditions present the invention appeared when the oil proportion was reduced to one-half of one per cent. on the ore. We do not understand, however, that this Court, in describing what actually took place at the birth of the invention, intended thereby to confine the invention, as to every oily liquid and every ore and every condition, to the use of one-half of one per cent. or less of oil to ore, especially as this Court specifically referred to the fact that "the composition of ores varies infinitely, each one presenting its special problem" and held to be within the law the statement of the specification that "when different ores are treated preliminary tests must be made to determine the amount of oil," etc., provided only that "such variation of treatment must be within the scope of the claims."

"Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct—

"Mr. Justice McReynolds: I want to know when your invention came into existence.

"Mr. Kenyon: This invention was not reached, I should say from those figures, until about 0.5, that is one-half of one per cent. of oil was reached.

"Mr. Justice McReynolds: At one per cent. you had no invention?

"Mr. Kenyon: No.

"Mr. Justice McReynolds: At one-half of one per cent. did you have invention?

"Mr. Kenyon: It began to come, remote, but it began to come. At 0.3 of one per cent. the float vastly increased, at 0.1 of one per cent. the float again vastly increased.

"Mr. Justice McReynolds: When this float is more than one-half of one per cent. of oil it does not infringe?

"Mr. Kenyon: It does not infringe.

"Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8% or perhaps more, of oil would give the same result, with increased agitation?

"Mr. Williams: Absolutely no.

"Mr. Kenyon: It would not.

"Mr. Justice Pitney: I understood him to say so yesterday, and I supposed there was something in the record to justify it.

"Mr. Kenyon: Nothing; that will be a part of my argument."*

It results from the views above expressed and from the similar ones expressed in the concurring opinion of Judge Hunt, that the decree appealed from must be and is reversed and the case remanded with directions to the court below to so modify its decree as to accord with the opin-

*The oral arguments from which this colloquy was taken were privately printed by the parties. This colloquy related wholly to oleic acid and Broken Hill ore, and did not relate to the scope of the claims or to the boundaries of the invention in general.

ions of the majority of this Court—the appellant to recover its costs on this appeal.**

HUNT, Judge, *concurring.* I will briefly state the ground upon which my concurrence rests.

The Supreme Court in sustaining the claims carefully noted those which were limited to a fraction of one per cent. and the decision explicitly confined the patent to the results obtained by the use of oil within the proportions often described in the testimony and in the claims.

Claims 1, 2 and 3 use the language amounting to a fraction of one per cent. on the ore.

Claims 5, 6 and 7 express amounts percentages on the ore.

Claim 12 uses the words of limitation amounting to a fraction of one per cent. of oil on the ore.

Claims 9, 10 and 11 make no reference to a fraction of one per cent. but do contain the words " a small quantity of oil."

The essence of the invention was in the use of this extremely small fraction of one per cent., and the Supreme

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**In the opinion as originally filed this paragraph did not appear and in its place appeared the following:

"Inasmuch as it appears without dispute that the appellant company has never used in its process any oil in quantity as small as one-half of one per cent., it results from the views above expressed that the judgment must be reversed and the case remanded with directions to the court below to dismiss the bill at the complainants' costs, without regard to the question raised respecting the sufficiency of the disclaimer filed by the appellees company or to its resultant effect.

It is so ordered."

This was corrected to its present form after defendant's counsel had called the attention of the Court to defendant's admission that until January 7, 1917, it had used oil in quantity not greater than one-half of one per cent. and had suggested modification of the Court's opinion. Thereupon the order modifying decree (*infra*, p. , R., Vol. , p.), was entered and the opinion and decree previously filed were corrected to their present form. Originally the decree directed final dismissal of bill. Now it finally adjudicates infringement from August 11, 1913, to January 7, 1917, and non-infringement thereafter, and orders an accounting for five and one-half years of infringement, and a permanent injunction pursuant to the decree. Nothing is left for determination except the amount of profits or damages to be awarded to plaintiff on the limited construction which the patent has received.

Court, while sustaining the fraction of one per cent. claims held invalid the small quantity claims, 9, 10, 11, because they were too broad. No monopoly could be given on the use of a small quantity of oil, for that was old. It was new, however, to avoid the use of larger quantities.* The patent must be confined to the use of critical proportions.

Now, keeping in mind that by the decision the court has limited the invention to the critical proportions often described in the testimony and in the claims, we naturally ask: What are the critical proportions described in the specifications? Page 1, line 79, of the specification says:

> "To this is added a very small proportion of oleic acid (say from 0.02 per cent. to 0.5 per cent. on the weight of the ore),"

*Here Judge Hunt agrees with Judge Ross in the assumption that the Circuit Court of Appeals in the Hyde case correctly decided that the results of the use of small and larger quantities of oil were identical; that the only thing which distinguished the process of the patent in suit from prior art processes was the avoidance of the use of the larger quantities of oil that were used in such prior art processes, and that the mistake made by the Circuit Court of Appeals in that decision, which was corrected by this Court in its reversing judgment, was a holding that this reduction in degree in one of the elements used in prior art processes to produce identical results was not patentable.

He assumes that this Court agreed with the Circuit Court of Appeals in respect of the prior art processes and the results attained thereby, and disagreed with it as to the patentability of a reduction in degree.

We respectfully submit that this assumption and decision of Judge Hunt are directly opposed to the decision of this Court in the Hyde case. This Court with entire clearness and so explicitly as to defy successful misconstruction, decided that the novelty of the process in suit was the different results achieved by it from the results achieved by any process of the prior art, and therefore that it was not a matter of degree in the amount of oil used, but was a matter in respect of the effect thereof and the results achieved thereby. In other words it decided the exact contrary of what the Circuit Court of Appeals had decided on this controlling point in the case.

This Court found a novel discovery in the results obtained by the use of oil within the limits of the claims of the patent, and affirmed the patent for that reason. It is inconceivable that it should have found novelty and patentability if it had agreed with the Circuit Court of Appeals that all that the patentees had discovered was the way to produce the old results by the old means but with a reduction in the amount of one of the materials used in the old processes. And yet it is respectfully submitted that this is just the meaning which Judge Hunt attributes to this Court's opinion in the Hyde case and upon which he bases his opinion in the instant case.

and on line 96 we have:

> "The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under 0.1 per cent. of the ore; but this proportion has been found suitable and economical."*

We thus have given to us one-half of one per cent. or less as the critical proportion described. Preferably one-tenth of one per cent. is to be used.

We also ask: What is the evidence wherein there is often described the "critical proportion"? A summary of it is that it is very nearly one-tenth of one per cent. or two-tenths of one per cent. as may be required for particular ore. All through the evidence it appears that minute and critical amounts of oil are to be used as necessary to make the process successful. From one pound of oil to the ton of ore (five hundredths of one per cent.) to four pounds per ton (two-tenths of one per cent.) were the limits in practical work as stated by witnesses.**

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*The part of the specification from which these quotations are taken commences with this statement, "The following is *an example* of the application of this invention to the concentration of *a particular ore*" (Spec., p. 1, lines 70-72, italics ours), and describes the application of the invention, with oleic acid as the oily substance, under described conditions, to Broken Hill ore.

**It is true that with the ores and the oils used by the licensees and infringer in the Hyde case the limits were as stated. But we submit that any inference therefrom that this Court intended to restrict the patent to these limits or to any other limits than those within the terms of the claims is entirely unjustified and unwarranted. The facts that a certain amount of a particular oil will produce the result, that a larger amount of a different oil would be necessary to produce the same result, that larger amounts of the same oils would be required by other ores, are undoubtedly true but immaterial in the matter of construction of the patent. This Court clearly perceived and stated this by saying: "The composition of ores varies infinitely"; "when different ores are treated preliminary tests must be made to determine the amount of oil," etc.; "such variation of treatment must be within the scope of the claims"; "range of treatment within the terms of the claims" is within the scope of the patent.

Again when counsel had the colloquy (quoted in the opinion of Judge Ross) with the Supreme Court, the guiding thought evident in the mind of the inquiring justices was to stamp precision upon the point when *invention in the process* began to appear.* With apparent definite purpose of meeting the interrogatories plaintiff told the court that "invention" began to come when in the descending uses of percentages of oil as small a quantity as five-tenths of one per cent. was used, and was first present when three and two-tenths of one per cent. was used. Of course a court should cautiously consider a response often quickly made by counsel in answer to questions put from the bench lest an injustice may follow by attaching undue weight to an isolated argumentative answer, but in this matter we are earnestly trying to gather the scope and accurate meaning of the expressed thought of the court. We may therefore refer to the fact that the exact position of the plaintiff as to the invention was called for not once but twice, not generally nor indirectly, but positively, simply and unequivocally. Hence in the controversy as to the true interpretation of the opinion the questions put and answers given may be fairly resorted to, not as conclusive at all but as aids toward a better understanding of the statement of the limitations of the claims of the patent and of the definition of the invention included in its language.

Nor do I think there is ground for saying that discrimination was had between known oils, whether vegetable, mineral or animal. To oily liquids which have a "preferential affinity to metalliferous matter" must the plaintiffs be held, and in using kerosene or fuel oil defendants are but employing oils which the patents author-

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*The whole colloquy, as noted under Judge Ross' opinion, related to a particular example—the application of the invention, with oleic acid as the oily liquid, under described conditions, to Broken Hill ore.

ize the use of,* and when defendants use proportions beyond the critical ones of oil, not oleic acid, but other oils, they are not infringing. Oils doubtless vary in being adaptable for use. Some will probably secure more froth than others, and oil formulae may in their ingredients depend upon the particular ore to be treated and upon the economic relationship to the problem under solution. But the froth developed in using the minute quantities of oil is, I think, essentially of a character like the froth shown when different quantities of oil are used**—the difference is largely by reason of a special quantity or kind of oil or the special extent of the agitation applied. The experiments made before us prove this.*

*This changes a statement of scope to a guarantee of the usefulness of everything within that scope, in contradiction of the statement of the specification, approved by this Court, that preliminary tests are necessary "to determine which oily substance yields the proportion of froth or scum desired" (Spec., pat. in suit, page 1, lines 67-69). The specification gives a single example of "an oily liquid having a preferential affinity for metalliferous matter," to wit, oleic acid, and describes its application, under certain conditions, to Broken Hill ore, and the metallurgist is directed to determine by tests the application of the invention to other ores—of different oils or oily liquids to different ores. The patent only authorizes the use of such oils or oily liquids as are found to be useful in the process, and *cautions the metallurgist* that in dealing with the infinity of ores and the infinity of oils and oily liquids he must make preliminary tests to determine usefulness.

The specification describes the air-lift and the metal-carrying air-froth that follow agitation where the oily substance is oleic acid and give this as an example of the invention. And all the claims s[illegible]ify and require that the oil-coated mineral matter form into a froth ([illegible]ims 9, 10 and 11 by disclaimer). If the oil or oily substance used is [illegible]ch that this operation will not proceed and this result cannot be obtai[illegible]d it is not the oil of the patent. Indeed this Court held explicitly in the Hyde case that the patent must be confined to these results.

**Judge Hunt is here reasserting the conclusion expressed by his Court in the Hyde case that all quantities of oil produce essentially the same froth, notwithstanding the wholly different conclusion plainly stated by this Court in reversing that decision.

*Judge Hunt is here expressing an opinion which would require the skill of a specially trained metallurgist, and in any event his opinion is in contradiction of the proved facts of the case. His statement that all froths look alike to him is not surprising but is irrelevant. It is a large fact of the case, indubitably proved, that the kerosene and fuel oil used by defendant are not useful mineral-froth-forming oils in the process in suit with defendant's ore or any ore with which they are known to have been tested in practical operations.

In the Cattermole process the froth was held to be distinguishable from the froth produced in the patented process of the critical proportion of oil by the fact that certain remarkable and great results come from the use of the critical proportion which were not obtained when the quantity used in the Cattermole process was employed.**

By using the critical proportion of oil as defined, patentees get the maximum froth. They have discovered a process—not a froth—and the process is limited to the use of oil in the specified critical proportion.

The sequel of these views is that inasmuch as defendants keep out of the limits made for the plaintiff by the decision of the Supreme Court by using more than the critical proportion they do not use plaintiffs' process.

MORROW, Circuit Judge, *concurring in part and dissenting in part:*

I concur in the opinion of the majority of the court that the decree should be reversed, but I do not concur in the direction that the bill be dismissed. I am of opinion that the use of an oil or oily liquid in defendant's separation process in a quantity not "amounting to more than a fraction of one per cent. on the ore"* is within the express terms of claims 1, 2, 3 and 12 of plaintiff's patent and is an infringement of such patent. But I am of opinion that the use of oil or oily liquid in a quantity amounting to

**Judge Hunt here reiterates the view expressed in the reversed opinion of his court in the Hyde case, that the Cattermole process produces a mineral-carrying froth, overlooking the clear statement in the decision of this Court reversing that decision, that the Cattermole process is a metal-sinking process—as it indubitably is. He also avoids characterizing the results of the invention as *new*, but merely says they were "remarkable and great," presumably from a financial standpoint.

*This is an accurate expression but not an exact quotation. The specification says, "if the proportion of oily substance be considerably reduced —say to a fraction of one per cent. on the ore," and claims 1, 2 and 3 say, "amounting to a fraction of one per cent. on the ore." This last expression is quoted in the opinion of this Court. Claim 12 says, "a fraction of one per cent. of oil on the ore."

more than a fraction of one per cent. on the ore is not within the terms of claims 1, 2, 3 and 12 and is therefore not an infringement upon plaintiff's process and that a decree should be entered accordingly.** The direction of the Supreme Court in Minerals Separation Ltd. vs. Hyde, 242 U. S., 261, is that:

> "The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as critical proportions amounting to a fraction of one per cent. on the ore."

The term critical proportions is not used in the claims of the patent but such proportions were described in the testimony in the Hyde case as the application of a small but exact quantity of oil to different ores and always within the range of treatment of "a fraction of one per cent. on the ore," never to the treatment of different ores within the range of "one-half of one per cent." except in the use of oleic acid and that upon certain ores such as Broken Hill ores. The application of the term "critical proportions" in the use of oil on ores generally within a range of "one-half of one per cent." was discovered by counsel for appellant in this case and so far as appears from the record was revealed to the public for the first time in this court.

The colloquy between Mr. Justice McReynolds and Mr. Kenyon, counsel for appellant, in the Supreme Court in

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**Judge Morrow, without giving his reasons therefor, here rejects the definite evidence and admissions by defendant which establish the fact beyond question that from the commencement of use of the process defendant successfully used much less than one per cent. of efficient or useful mineral-froth-forming oil, and has always continued so to use it; and that the effort to escape infringement consisted in adding, to a small fraction of one per cent. of this useful oil, a larger quantity of other oils which were not useful or mineral-froth-forming oils of the process, but which increased the total quantity of oil used so that it slightly exceeded one per cent., thereby impairing but not destroying the operation and results of the process in suit.

the Hyde case, referred to by Judge Ross in his opinion, related to the use of oleic acid on Broken Hill ores concerning which I do not understand that there is any controversy. I think the direction of the Supreme Court that

> "The patent must be confined to the results obtained by the use of oil within the proportions * * * amounting to a fraction of one per cent. on the ore"

means just what it says, and that within such proportions the process described in the patent is held by the Supreme Court to be a valid discovery protected by the Specifications and Claims numbered 1, 2, 3 and 12. The Supreme Court does not say that the patent must be confined to the oleic acid claims (claims 5, 6 and 7), nor does it say that the other claims of the patent must be confined to the use of oil in the fraction mentioned in those claims.* Had the Supreme Court intended that the scope of the patent should be confined to the use of oil in the proportion not to exceed one-half of one per cent. on the ore, it would certainly have said so in so many words and would not have left it to be inferred that the patent must be confined to results obtained by the use of oil in such proportions as are limited in claims 5, 6 and 7. For what purpose does the court hold claims 1, 2, 3 and 12 valid? Manifestly because these claims provide for the use of oil in the proportions "amounting to a fraction of one per cent. on the ore"; that is to say, upon ores generally.

The specifications mention the fact that the ores were not all alike and that different ores may require the use of different proportions of oily material in order to secure the desired separation of metalliferous matter from the gangue by the production of a froth. The Supreme Court commenting upon this variation in the requirements of the process said:

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*The upper limit stated in these oleic acid claims is one-half of one per cent. on (relative to) the ore.

> "Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject-matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows."

The use of oleic acid on Broken Hill ore was the oil and the ore of the discovery and the proportion of the oil used is described in claims 5, 6 and 7. But how about the use of other oils on other than Broken Hill ores? The proportions required for oleic acid on Broken Hill ores had been determined by actual tests but other oils and other ores had not been fully tested and the application of the process might require a different proportion of oily material upon a different class of ores. To meet such a contingency, claims 1, 2, 3 and 12 call for the use of an oil or oily liquid "amounting to the [a] fraction of one per cent. on the ore." Furthermore, in declaring claims 9, 10 and 11 invalid, the Supreme Court clearly did so because such claims were not confined to the use of oil "amounting to a fraction of one per cent. on the ore." The claim was for the use of "a small quantity of oil," which might be a quantity more than "a fraction of one per cent. on the ore."

The validity of the other claims in controversy having been sustained upon their limitation of the use of oil within the proportions "amounting to a fraction of one per cent. on the ore," it followed that claims 9, 10 and 11 were held invalid because they were not so confined,

and were therefore too broad. The disclaimer accordingly disclaims from claims 9, 10 and 11 of the patent "any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore." Such language was strictly in accordance with the decision of the Supreme Court and I think a sufficient rejection of the excess from the invention claimed, leaving the patent in the form limited by the opinion of the Supreme Court.

With respect to the objection that the disclaimer was not filed in time, the mandate of the Supreme Court became effective January 13, 1917, decreeing the patent to be invalid as to claims 9, 10 and 11, but valid as to the other claims in issue. On March 28, 1917, the plaintiffs filed their disclaimer, some time before the right to petition for a rehearing in the Supreme Court had expired. Considering the importance of the procedure to be followed, the residence of the patentees in another country and the consequent delay in communication, the date of filing was not unreasonably delayed.

At a stated Term, to-wit: the October Term A. D. 1917, of the United States Circuit Court of Appeals for the Ninth Circuit, held in the Court-Room thereof, in the City and County of San Francisco, in the State of California, on Monday the twentieth day of May, in the year of our Lord One Thousand Nine Hundred and Eighteen.

Present—Honorable WILLIAM B. GILBERT, Senior Circuit Judge, Presiding,
Honorable ERSKINE M. ROSS, Circuit Judge,
Honorable WILLIAM H. HUNT, Circuit Judge.

BUTTE AND SUPERIOR MINING COMPANY, Designated as BUTTE AND SUPERIOR COPPER COMPANY, LIMITED, a Corporation,

Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation; MINERAL SEPARATION NORTH AMERICAN CORPORATION, a Corporation,

Appellees.

No. 3081.

ORDER MODIFYING DECREE.

ROSS, Circuit Judge, HUNT, Circuit Judge, concurring, MORROW, Circuit Judge, concurring in the reversal but dissenting from the modification of the decree herein directed and as to costs.

Understanding from the presentation of this case that the real and pivotal question for the decision of this Court was whether or not under the decision of the Supreme Court in the case of Minerals Separation, Ltd. vs. Hyde, 242 U. S., 261, the use of any oil by the appellant in quantity of one per cent. or less on the ore, constituted an infringement of the appellees' patent, and that the fact was undisputed that the appellant had not used as little as one-half of one per cent. of oil in its process, in reversing the judgment of the court below we directed that court to dismiss the bill at the complainant's cost.*

Inasmuch, however, as it appears and is admitted that prior to and including January 7, 1917, the appellant did use in its process oil in quantities of one-half of one per cent. and less, thereby in those instances infringing the patent of the appellees.

It is hereby ordered that the judgment of this Court herein rendered and entered May 13, 1918, be and hereby is corrected so as to read as follows:

The decree appealed from must be and is reversed and the case remanded with directions to the Court below to so modify its decree as to accord with the opinions of the majority of this Court, the appellant to recover its costs on this appeal.

Entered May 20, 1918.

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*This was the direction concluding the opinion of the Court, by Judge Ross, as originally filed (see footnote, *supra*, p. 32) and the decree so ordered as originally filed. The opinion and original decree were corrected, after filing, to their present form to accord with this order modifying decree. Thus a final decree dismissing the bill was corrected to a decree final as to all acts of defendant employing more than one-half of one per cent. of oil relative to the ore and finally adjudicating that the defendant infringed in all acts employing one-half of one per cent. or less of oil relative to ore, but interlocutory as to the latter acts in that an accounting was ordered.

NOTICE.

THOMAS F. SHERIDAN,
J. EDGAR BULL,
FREDERICK P. FISH,
J. BRUCE KREMER,
Counsel for Butte & Superior Mining Company.

Gentlemen:

Will you please take notice that on Monday the 7th day of October, 1918, at 12 o'clock noon, or as soon thereafter as counsel can be heard, the foregoing Petition and Appendix and the accompanying Brief and Appendix will be submitted to the Supreme Court of the United States at its usual place of holding its sessions in the Capitol at Washington, D. C., for its consideration and action, at which time and place you will please take such action in the premises as you may be advised.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
GARRET W. McENERNEY,
ODELL W. McCONNELL,
Counsel for Petitioners.

ADMISSION OF SERVICE.

Service of a copy of the foregoing Petition and Appendix and accompanying Brief and Appendix is acknowledged this day of August, 1918.